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PREFACE

The purpose of the *Energy Fact Book* is to provide key information on energy markets in Canada in a format that is easy to consult. Resources including a summary of units and conversion factors, abbreviations, and data sources used throughout this publication are available in the annexes.

All data is subject to revisions by statistical sources. In some instances, more than one source may be available and discrepancies in numbers may occur because of conceptual or methodological differences. In addition, some numbers may not add up precisely due to rounding.

This publication was assembled by the Energy and Economic Analysis Division of the Energy Policy and International Affairs Branch with the help of subject experts from across Natural Resources Canada (NRCan).

For questions or comments, contact NRCan at nrcan.energyfacts-faitsenergetiques.rncan@canada.ca.

In this publication, energy industries are generally considered to include oil and gas extraction; coal mining; uranium mining; electric power generation, transmission and distribution; pipeline transportation; natural gas distribution; biofuels production; petroleum refineries; and support activities for oil and gas extraction. The petroleum sector is a subset of these industries, and in this publication consists of oil and gas extraction and support activities, pipeline transportation and distribution of oil and gas, and petroleum refineries.

Clean energy industries such as renewable and nuclear electricity generation, biofuels production and carbon capture and storage facilities are contained within the definition of energy industries. Some energy-related industries (e.g. petroleum product wholesaler-distributors and coal product manufacturing) are excluded because of a lack of data.
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</tbody>
</table>
INTRODUCTION

From an energy perspective, Canada is very fortunate. We have a large land mass, small population and one of the largest and most diverse supplies of energy in the world. Our rivers discharge close to 7% of the world’s renewable water – a tremendous source of hydroelectric power. We have the fourth-largest proven oil reserves and third-largest reserves of uranium; our energy resources are a source of strength that continues to shape our economy and society.

Canada is at the forefront of innovative technologies for how we produce and use energy. For example, low- or non-emitting forms of energy are growing in significance as part of our evolving electricity mix. In fact, wind and solar photovoltaic (PV) energy are the fastest-growing sources of electricity generation in Canada. In addition, technological advancements, such as co-generation, have resulted in an increase in energy-efficient practices and a reduction in greenhouse gas (GHG) emissions in areas such as the oil sands. Ongoing developments in areas such as grid-scale electricity storage, carbon capture and storage, hydrogen, and electric and alternative fuel vehicles have the potential to further transform the energy system.

For over ten years, the *Energy Fact Book* has provided a solid foundation for Canadians to understand and discuss important developments across the energy sector. A significant milestone in Canadian energy information was achieved in 2019 with the launch of the Canadian Center for Energy Information (CCEI). Housed at Statistics Canada, the CCEI brings together Canada’s existing energy information in one place, facilitating access to products like the Energy Fact Book.
Section 1: Key Energy, Economic and Environmental Indicators

- Energy production and supply
- Economic contributions
- Energy and GHG emissions
ENERGY PRODUCTION AND SUPPLY

CANADA: A GLOBAL ENERGY LEADER

The amount of primary energy produced by Canada in 2020 is 29% more than in 2005. The world, on average, has increased energy production by 23% in the same period.

WORLD TOTAL PRIMARY ENERGY PRODUCTION

TOP ENERGY PRODUCERS, 2020

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>20%</td>
</tr>
<tr>
<td>2</td>
<td>United States</td>
<td>15%</td>
</tr>
<tr>
<td>3</td>
<td>Russia</td>
<td>10%</td>
</tr>
<tr>
<td>4</td>
<td>Saudi Arabia</td>
<td>4%</td>
</tr>
<tr>
<td>5</td>
<td>India</td>
<td>4%</td>
</tr>
<tr>
<td>6</td>
<td>Canada</td>
<td>4%</td>
</tr>
</tbody>
</table>

GLOBAL ENERGY RANKINGS FOR CANADA

<table>
<thead>
<tr>
<th>Resource</th>
<th>Proved reserve/capacity</th>
<th>Production</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude oil</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Uranium</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Hydroelectricity</td>
<td>3</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Electricity</td>
<td>8</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Coal</td>
<td>16</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Natural gas</td>
<td>17</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
CANADIAN ENERGY PRODUCTION

Primary energy is energy that is found in nature before any processing or conversion. The *Energy Fact Book* calculates primary energy production by using two methods. The first method treats the energy embodied in uranium as primary energy, thereby capturing the uranium Canada produces and then exports. This method provides a more accurate picture of energy production in Canada.

The second method—also employed by the International Energy Agency (IEA), the Energy Information Administration (EIA) and others—treats domestic electricity production from nuclear energy as primary energy, but not uranium itself. Uranium is energy-dense, and Canada exports most of its uranium production, which explains why the two methods produce such different results.
“Other renewables” includes wind, solar, wood/wood waste, biofuels and municipal waste.
PRIMARY ENERGY PRODUCTION BY REGION AND SOURCE (2020)

PRIMARY ENERGY PRODUCTION, INCLUDING URANIUM

Petajoules

PRIMARY ENERGY PRODUCTION, EXCLUDING URANIUM

Petajoules

Energy Fact Book 5
CANADA’S ENERGY SUPPLY

A look at Canada’s total energy supply (TES) helps to better understand the impact of energy sources on GHG emissions. The TES is calculated as:

\[ \text{TES} = \text{PRODUCTION} + \text{IMPORTS} - \text{EXPORTS} + \text{STOCK CHANGES} \]

- Fossil fuels made up 75% of Canada’s TES in 2020.
- Renewable energy sources made up 17.3% of Canada’s TES in 2020.

Comparatively, the global TES is made up of:

- **Fossil fuel** (oil 31%, coal 27%, natural gas 23%)
- **Renewables** 14%
- **Nuclear** 5%

* not including electricity trade
**“Other renewables” includes wind, solar and geothermal.
1 For the purposes of TES, electricity production is calculated by using the energy content of the electricity (i.e. at a rate of 1 TWh = 0.086 Mtoe), with the exception of nuclear electricity, which is calculated assuming a 33% conversion efficiency factor increase (i.e. 1 TWh = 0.086 ÷ 0.33 Mtoe).
**ECONOMIC CONTRIBUTIONS**

**NOMINAL GROSS DOMESTIC PRODUCT (2021)**

**ENERGY’S NOMINAL GDP CONTRIBUTION FOR CANADA**

**NOMINAL GDP (% OF CURRENT DOLLARS)**

- **9.7%**
- or
- **$226 billion**

**CANADIAN GDP**

- **ENERGY DIRECT 7.7% ($180 billion)**
  - PETROLEUM 5.7%
  - ELECTRICITY 1.7%
  - OTHER 0.3%
- **ENERGY INDIRECT 2.0% ($47 billion)**

Parts may not sum to total due to rounding. The indirect contribution is not comparable to previously published estimates due to revisions and a change in estimation methodology by Statistics Canada. For more information on Statistics Canada’s estimation methodology, please contact statcan.iadinfodci-dciinfoiad.statcan@statcan.gc.ca.
ENERGY’S NOMINAL GDP CONTRIBUTION BY PROVINCE/TERRITORY (2021)

Energy sector direct nominal GDP* ($ millions)

*Provincial/territorial figures do not sum precisely to the national total, due to differences in data methodology. Distribution is based on 2020 proportions.
EMPLOYMENT IN CANADA’S ENERGY SECTOR (2021)

DIRECT: 264,700 JOBS
INDIRECT: 369,900 JOBS
TOTAL: 634,600 JOBS

ENERGY SECTOR DIRECT EMPLOYMENT BY PROVINCE/TERRITORY*

- About 15,000 Indigenous people living off-reserve are directly employed in the energy sector.

SHARE OF TOTAL EMPLOYMENT, 2021

- ENERGY DIRECT* 1.4%
  - PETROLEUM 0.9%
  - ELECTRICITY 0.5%
  - OTHER 0.1%

- ENERGY INDIRECT 2.0%

TOTAL EMPLOYMENT

DIRECT: 264,700 JOBS
INDIRECT: 369,900 JOBS
TOTAL: 634,600 JOBS

*Provincial/territorial and sectoral employment figures do not sum precisely to the national total due to rounding.

The indirect contribution is not comparable to previously published estimates due to revisions and a change in estimation methodology by Statistics Canada. For more information on Statistics Canada’s estimation methodology, please contact statcan.iadinfodci-dciinfoiad.statcan@statcan.gc.ca.
Parts may not sum to total due to rounding. The indirect contribution is not comparable to previously published estimates due to revisions and a change in estimation methodology by Statistics Canada. For more information on Statistics Canada’s estimation methodology, please contact statcan.iadinfoddci-dciinfoiad.statcan@statcan.gc.ca.
ENERGY SECTOR GDP
(Billions of dollars)

Parts may not sum to total due to rounding. The indirect contribution is not comparable to previously published estimates due to revisions and a change in estimation methodology by Statistics Canada. For more information on Statistics Canada’s estimation methodology, please contact statcan.iadinfodci-dciinfoad.statcan@statcan.gc.ca.
ENERGY TRADE (2021)

Energy exports

$154.3 billion
representing
32%
of total Canadian goods exports

Oil and gas domestic exports totalled
$140 billion
of which
96%
were to the U.S.

The U.S. accounts for
91%
of energy exports by value
($139.8 billion).

Exports to the U.S.

Crude oil
% of exports destined for U.S.: 98
% of Canadian production exported to U.S.: 77
% of U.S. imports coming from Canada: 62
% of U.S. consumption supplied by Canada: 25

Natural gas
% of exports destined for U.S.: 100
% of Canadian production exported to U.S.: 46
% of U.S. imports coming from Canada: 99
% of U.S. consumption supplied by Canada: 9

Electricity
% of exports destined for U.S.: 100
% of Canadian production exported to U.S.: 8
% of U.S. imports coming from Canada: 91
% of U.S. consumption supplied by Canada: 1

Coal*
% of exports destined for U.S.: 3
% of Canadian production exported to U.S.: 1
% of U.S. imports coming from Canada: 19
% of U.S. consumption supplied by Canada: 0.2

---

*% of Canadian coal production exported is based on 2020 values.
Energy imports
$42.6 billion representing 14% of total Canadian goods imports

The U.S. accounts for 73% of energy imports by value ($31 billion).

Imports from the U.S.

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>% of Canadian imports originating from U.S.</th>
<th>% of U.S. exports destined for Canada</th>
<th>% of Canadian consumption supplied by U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude oil</td>
<td>66</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>Natural gas</td>
<td>97</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Electricity</td>
<td>100</td>
<td>73</td>
<td>2</td>
</tr>
<tr>
<td>Coal*</td>
<td>72</td>
<td>5</td>
<td>21</td>
</tr>
</tbody>
</table>

*% of Canadian coal consumption imported is based on 2020 values.
GOVERNMENT REVENUES

Federal and provincial/territorial governments in Canada receive direct revenues from energy industries through corporate income taxes, indirect taxes (such as sales and payroll taxes), crown royalties, which are the share of the value of oil and gas extracted that is paid to the Crown as the resource owner, and crown land sales, which are paid to the Crown in order to acquire the resource use for specific properties.

- An important share of government revenues is collected from the petroleum sector, which averaged $13 billion over the last five years, including $10 billion from upstream oil and gas extraction and its support activities.
- Between 2015 and 2019, the energy sector’s share of taxes paid by all industries was 6.9%. Operating revenues of the energy sector represented 9.6% of all operating revenues earned by industries in Canada.

GOVERNMENT ENERGY REVENUE, 2015-2019 AVERAGE ($ BILLIONS)

- ROYALTIES: $6.6, 44%
- CORPORATE INCOME TAXES: $3.8, 26%
- INDIRECT TAXES: $3.4, 23%
- LAND SALES: $1.1, 7%
- TOTAL: $14.9

*Parts may not sum to total due to rounding.
TOTAL TAXES PAID BY ENERGY INDUSTRIES
(includes corporate income taxes and indirect taxes)

$ billion


Oil and gas extraction and support activities
Petroleum and coal product manufacturing
Utilities
Pipelines
In Canada, about 80% of emissions come from energy. Canadians use more energy because of our extreme temperatures, vast landscape and dispersed population.

The challenges of transitioning to a lower-carbon energy system are numerous, but they also present opportunities for Canada to be a global leader by supporting innovative technologies in the energy sector, including promoting our growing renewables and cleantech sectors.
Since 2000, there has been a decoupling between the growth of Canada’s economy and GHG emissions, largely because of technological improvements, regulations, and more efficient practices and equipment.

The year 2020 was marked by the COVID-19 pandemic, coinciding with a decrease in emissions of 66 Mt or 8.9%.

Between 2000 and 2020, Canada’s GHG emissions decreased by 7.5% while GDP increased 39%.

GHG emissions decreased 34% per dollar of GDP and 26% per capita.
- Between 2000 and 2020, emissions from electricity production decreased 56%, largely because of Ontario’s successful coal phase-out action plan, which started in 2001.

- Emissions from oil and gas production increased 15% largely due to an increase of 50% in production.

- Emissions from heavy industry have decreased by 24% despite an increase in output of the industrial sector. This is due in part to improvements in energy efficiency and fuel switching.
Section 2: Investment

- Capital expenditures
- Canada’s Energy Infrastructure and Major Energy Projects
- Foreign Direct Investment and Canadian Direct Investment Abroad
- Canadian Energy Assets Abroad, foreign control of assets
- RD&D and Mission Innovation
- Environmental Protection Expenditures
Capital expenditures in Canada’s energy sector totaled $66 billion in 2021, a decrease of 44% from a peak in 2014.

After reaching an eleven year low of $59 billion in 2020, investment rebounded slightly to $66 billion in 2021.

Electric power generation and distribution was the largest area of energy sector capital expenditure at $25.3 billion in 2021, surpassing oil and gas extraction ($23.9 billion) for the first time.

*Excludes residential expenditures and intellectual property investments such as exploration expenses. Includes investments in renewable electricity, does not capture other forms of renewable energy.
CANADA’S ENERGY INFRASTRUCTURE

Fuel, energy and pipeline infrastructure made up the largest proportion of Canada’s infrastructure at 31% of net stock in 2021.

Statistics Canada defines infrastructure as:

the physical structures and systems that support the production of goods and services and their delivery to and consumption by governments, businesses and citizens.

Fuel, energy and pipeline infrastructure includes electric power infrastructure like wind and solar, hydro, nuclear, and thermal generation, power transmission and distribution lines and oil and gas pipelines.
FUEL, ENERGY AND PIPELINE INFRASTRUCTURE INVESTMENT AND OPERATIONS

created 115.7k jobs

generated $9.5 billion in employment income

and $18.0 billion in GDP in 2021 (direct and indirect contributions).

Public and private investment in fuel, energy and pipeline infrastructure in 2021 was $23.6 billion (nominal).
Public and private investment in fuel, energy and pipeline infrastructure in 2021 was $23.6 billion (nominal).
CANADA’S MAJOR ENERGY PROJECTS

- In 2022, there were 320 planned (announced, under review, or approved) energy projects worth $427 B, and 61 energy projects under construction worth $46.5 B.
- Oil and gas sector projects accounted for the largest portion of project value ($298 billion), while there were more electricity projects overall (179).
- There were 183 clean technology projects valued at $116 B.

Natural Resources Canada’s Major Projects Inventory captures information on major natural resource projects in Canada that are either currently under construction or planned in the next 10 years.

Minimum capital thresholds for inclusion are: $50 million for oil and gas, $20 million for electricity, and $10 million for other clean energy or technology projects.

Projects that are either announced, under review, approved and under construction are included.
# Clean Technology Project Trends 2018-2022

<table>
<thead>
<tr>
<th></th>
<th>2018 Projects</th>
<th>2019 Projects</th>
<th>2020 Projects</th>
<th>2021 Projects</th>
<th>2022 Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Clean Technology Projects</strong></td>
<td>144 projects ($109.5B)</td>
<td>151 projects ($99.3B)</td>
<td>148 projects ($94.5B)</td>
<td>170 projects ($103.0B)</td>
<td>183 projects ($116.0B)</td>
</tr>
<tr>
<td><strong>Hydro</strong></td>
<td>65 projects ($48.2B)</td>
<td>70 projects ($50.0B)</td>
<td>60 projects ($48.3B)</td>
<td>59 projects ($39.2B)</td>
<td>63 projects ($44.8B)</td>
</tr>
<tr>
<td><strong>Wind</strong></td>
<td>27 projects ($9.1B)</td>
<td>31 projects ($9.4B)</td>
<td>34 projects ($7.8B)</td>
<td>39 projects ($14.1B)</td>
<td>30 projects ($12.1B)</td>
</tr>
<tr>
<td><strong>Biomass/Biofuels</strong></td>
<td>33 projects ($6.4B)</td>
<td>32 projects ($3.0B)</td>
<td>28 projects ($4.5B)</td>
<td>30 projects ($7.9B)</td>
<td>34 projects ($9.3B)</td>
</tr>
<tr>
<td><strong>Solar</strong></td>
<td>7 projects ($0.9B)</td>
<td>6 projects ($0.7B)</td>
<td>8 projects ($0.9B)</td>
<td>20 projects ($3.2B)</td>
<td>28 projects ($2.8B)</td>
</tr>
<tr>
<td><strong>Nuclear</strong></td>
<td>5 projects ($28.5B)</td>
<td>5 projects ($28.5B)</td>
<td>3 projects ($26.1B)</td>
<td>4 projects ($27.4B)</td>
<td>3 projects ($26.1B)</td>
</tr>
<tr>
<td><strong>Carbon Capture and Storage</strong></td>
<td>3 projects ($16.3B)</td>
<td>2 projects ($7.2B)</td>
<td>1 project ($6.0B)</td>
<td>1 project ($10.0B)</td>
<td>7 projects ($15.5B)</td>
</tr>
<tr>
<td><strong>Geothermal</strong></td>
<td>1 project ($0.0B)</td>
<td>2 projects ($0.2B)</td>
<td>3 projects ($0.3B)</td>
<td>5 projects ($0.4B)</td>
<td>4 projects ($0.4B)</td>
</tr>
<tr>
<td><strong>Tidal</strong></td>
<td>0 project ($0.0B)</td>
<td>1 project ($0.1B)</td>
<td>5 projects ($0.3B)</td>
<td>5 projects ($0.3B)</td>
<td>6 projects ($0.4B)</td>
</tr>
<tr>
<td><strong>Other¹</strong></td>
<td>3 projects ($0.1B)</td>
<td>2 projects ($0.1B)</td>
<td>6 projects ($0.3B)</td>
<td>7 projects ($0.5B)</td>
<td>8 projects ($4.6B)</td>
</tr>
</tbody>
</table>

¹ Other includes novel initiatives such as micro-grid projects, battery storage projects, bioplastics, and a helium purification plant.
MAJOR ENERGY PROJECTS
PLANNED AND UNDER CONSTRUCTION, 2022-2032
INTERNATIONAL INVESTMENTS AND INVESTORS

Canada’s energy industries operate in free markets, where investments by both Canadian and foreign companies ensure an efficient, competitive and innovative energy system.

Stock of foreign direct investment (FDI)* in Canada and Canadian direct investment abroad (CDIA) in the energy industry

* Direct investment is defined as a company owning a minimum of 10% of voting equity interest in a foreign enterprise and is measured as the total equity value at the time of acquisition. Excludes residential expenditures and intellectual property investments such as exploration expenses.

FDI and CDIA include investments in renewable electricity, do not capture other forms of renewable energy.
STOCK OF FOREIGN DIRECT INVESTMENT IN CANADA AND CANADIAN DIRECT INVESTMENT ABROAD

- The stock of foreign direct investment (FDI) in the energy sector rose significantly in 2021 to **$201 billion** (+8.8% over the previous year).
- The energy industry’s share of overall FDI in Canada was **19%** in 2021, relatively unchanged from 2020.
- The stock of Canadian direct investment abroad (CDIA) was valued at **$170 billion** in 2021, down **0.6%** from 2020.
- Investment in oil and gas extraction accounted for **$62 billion** of the CDIA stock in 2021.

FOREIGN CONTROL OF CANADIAN ASSETS

Foreign control is a measure of the extent to which foreign entities operate in Canada. Generally, a corporation is deemed to be foreign-controlled if more than **50%** of its shares are owned by one or more foreign companies.
The total value of Canadian* energy assets (CEA) went down in 2020 to $695 billion, a slight decrease of 2.5% from $712 billion in 2019. In 2020, domestic CEA totaled $480 billion, down 4.0% from 2019, while CEA abroad totaled $215 billion, up from $213 billion.

* A Canadian company is here defined as a publicly traded company headquartered in Canada and not foreign-controlled.
RESEARCH, DEVELOPMENT AND DEMONSTRATION

CANADIAN EXPENDITURES ON TOTAL ENERGY RD&D

In 2020-21, federal energy RD&D expenditures were $837 M and provincial and territorial (P&T) government energy RD&D expenditures were $325 M, for a combined total of $1,162 M.

In 2020-21, federal spending increased by 10% ($79 M increase), primarily driven by energy efficiency related activities. Energy efficiency increased to $367 M in 2020-21, compared to $322 M in 2019-20.

At COP21 in 2015, Canada joined Mission Innovation and committed to double its public investment in clean energy RD&D over five years. At the Sixth Mission Innovation Ministerial in June 2021, Canada announced that it had met its doubling pledge in clean energy RD&D by 2020, with actual spending of $786.8 million in 2019-20 — exceeding its $775 M target. While MI’s doubling commitment period has ended, MI members, including Canada, have committed to continue to sustain, and wherever possible increase investment in clean energy RD&D during MI’s second phase.

In 2020-21, P&T spending slightly increased by 3% ($9M increase). CCUS continued to decline with spending decreased by 88% to $8M in 2020-21, compared to $69M in 2019-20.

The Canadian industry spent about $1.7 B on energy R&D in 2020, a slight increase from the spending reported in 2019.
Overall, federal, provincial and territorial spending recovered from the decline in 2019-20 to re-attain 2018-19 levels.
## EXPENDITURES ON ENERGY RD&D BY TECHNOLOGY AREA
### ($ MILLIONS)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrocarbons (including CCUS)</td>
<td>135</td>
<td>73</td>
<td>621</td>
</tr>
<tr>
<td>Renewable and non-emitting energy**</td>
<td>296</td>
<td>150</td>
<td>596</td>
</tr>
<tr>
<td>Energy end use***</td>
<td>406</td>
<td>102</td>
<td>457</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>837</strong></td>
<td><strong>325</strong></td>
<td><strong>1,675</strong></td>
</tr>
</tbody>
</table>

* Totals may not be exact due to rounding.
** Renewable and non-emitting energy includes renewable and nuclear energy.
*** Energy end use includes energy efficiency related to transport, industry, and buildings & communities.
Environmental protection expenditures (operating and capital spending combined) by the energy sector totalled $4.2 billion in 2019, representing 48% of expenditures made by all industries.

The oil and gas sector ($3.1 billion) accounts for the largest share of those expenditures, slightly more than one-third (34%) of total environmental protection expenditures made by all industries.

- Electric power generation, transmission and distribution invested $660 million on environmental protection measures.
- Petroleum and coal product manufacturing invested $501 million in environmental protection activities, the largest percentage of spending (94%) in pollution abatement and control.
Section 3: Skills, Diversity and Community

Energy sector demographics
Energy affordability
Energy reliant communities
ENERGY SECTOR DEMOGRAPHICS (2019)

**Women held 31% of energy sector jobs.**

**Over two-thirds (69%) of employees in the energy sector had more than a high school education and 52% of workers had a college diploma or university degree.**

**The workforce in the energy sector has been aging over time. In 2019, the proportion of employees aged 55 years and older stood at 21%, up from 14% in 2009.**

**Over the last decade, the workforce in the energy sector has become increasingly diverse. In 2019, 18% of the workforce identified as members of a visible minority group, up from 14% in 2009.**

**Immigrant workers represented 29% of energy sector employees compared to 25% in the total economy.**

5% of energy sector employees identified as Indigenous.
• Energy sector jobs paid an average of **$112,706 per year**, while the average Canadian job paid **$56,783**.

• The **gender wage gap** closed slightly in the energy sector in 2019, with women earning on average **91%** of the hourly wage earned by men. In contrast, in 2009, women earned on average **84%** of the hourly wages earned by men.

• Jobs requiring a **university degree** had the highest average compensation, reaching **$148,054**.

• Among **occupation types**, women in the energy sector are highly represented in office roles (administrative, general office worker, and auditor accountants and investment professionals) at **82% of these occupations**. Men are highly represented in trades (holding 97% of these occupations).

• Conversely, women in the trades earn on average **128%** of the hourly wage earned by men, while those working in administrative occupations earn on average **67%** of the hourly wage earned by men.
Representation of demographic groups in the energy sector compared to all industries

Representation of workers
- Energy sector
- All industries
ENERGY AFFORDABILITY

In 2019, in-home energy expenditure by Canadian households averaged $2,102. This represented 3% of the average disposable income.

When households spend 10% or more of their income on energy needs, this is referred to as energy poverty. Overall, 6% of Canadian households spent 10% or more of their income on energy. This share varies considerably across regions and income levels.

<table>
<thead>
<tr>
<th>Energy poverty rates, by income quintile and geography</th>
</tr>
</thead>
<tbody>
<tr>
<td>****</td>
</tr>
<tr>
<td>Canada</td>
</tr>
<tr>
<td>Atlantic Provinces</td>
</tr>
<tr>
<td>Que.</td>
</tr>
<tr>
<td>Ont.</td>
</tr>
<tr>
<td>Man.</td>
</tr>
<tr>
<td>Sask.</td>
</tr>
<tr>
<td>Alta.</td>
</tr>
<tr>
<td>B.C.</td>
</tr>
</tbody>
</table>

Energy poverty rates are based on the number of energy poor households divided by total households for a given income quintile and region.

Energy, in this context, includes what is needed inside the home (i.e. space heating, appliances), and excludes transportation.
HOUSEHOLD EXPENDITURES ON ENERGY

- Canadian households spent $4,524 on average on energy in 2019.
- Residential expenditures, including for heating/cooling spaces, lighting and operating appliances, averaged $2,102.
- Transportation expenditures averaged $2,422.
- Energy accounted for 6.6% of current household consumption. Lower-income households spend a larger share of their disposable income on energy.

ENERGY RETAIL PRICES

- The “energy” component of the consumer price index (CPI) has been volatile in recent years and has grown much faster than the non-energy component.
- This volatility reflects mostly the variations of upstream oil and gas prices and their impact on consumer products such as gasoline.
IN COMPARISON WITH OTHER DEVELOPED ECONOMIES, CANADA’S ENERGY PRICES ARE RELATIVELY LOW.

Household energy prices per unit, 2020

- Canada
- France
- Germany
- Italy
- United Kingdom
- United States
- OECD

- Mid-grade motor gasoline (left axis)
- Electricity (right axis)
- Natural gas (right axis)
ENERGY RELIANT COMMUNITIES

Communities that have higher shares of employment from a specific sector, a relatively high share of total income from that sector, and relatively low sectoral diversity in their economy compared to the average Canadian community can be described as reliant on that sector.

There are 300 communities across Canada that are at least moderately reliant on the energy sector. Of these communities, 79% are rural or remote.

Distribution of energy reliant communities across Canada
Section 4: Energy Efficiency

Energy use
Efficiency trends
ENERGY USE

PRIMARY AND SECONDARY ENERGY USE BY SECTOR (2019)

- Primary energy use measures the total energy requirements of all energy users.
- Secondary energy use accounts for the energy used by final consumers in the economy.
- Primary energy use includes secondary energy use. Additionally, primary energy use includes the energy required to transform one form of energy into another (e.g. coal to electricity); the energy used to bring energy supplies to the consumer (e.g. pipeline); and the energy used to feed industrial production processes (e.g. the natural gas used as feedstock by the chemical industries).
- Not every fuel is consumed as energy. For example, hydrocarbon gas liquids in Canada are also used as a non-energy feedstock in the petrochemical industry.
- Canada's primary energy consumed was estimated at 13,276 PJ.

*Secondary energy refers to the energy used directly by the final end users.*
• Secondary energy use includes the energy used to run vehicles; the energy used to heat and cool buildings; and the energy required to run machinery.

• Canada’s secondary energy use in 2019 was **9,683 PJ**.

• Total secondary energy use increased 20% from 2000 to 2019. Natural gas usage grew by 40% while electricity usage increased 15%, during the same period.

* “Other” includes coal, coke, coke oven gas, NGLs and steam and waste.
ENERGY IN OUR DAILY LIVES

Canadian households use energy every day – to power lights and appliances, heat or cool spaces, run personal vehicles, recharge electronics and more.

- **81%** of residential energy consumption is used for space and water heating.
- Residential energy efficiency improved by **32%** between 2000 and 2019, **saving 440 PJ** of energy and **$8.5 billion in energy costs**.
RESIDENTIAL ENERGY USE, BY TYPE (PJ), 2019

TOTAL
1,536 PJ

SPACE HEATING
977.6 64%

LIGHTING
53.8 3%

APPLIANCES
216.1 14%

WATER HEATING
263.9 17%

SPACE COOLING
25.0 2%

WATER-HEATING ENERGY USE (PJ), 2019

ELECTRICITY
69 26%

HEATING OIL
150 55%

WOOD
110 11%

OTHER
1 1%

TOTAL
264 PJ

SPACE-HEATING ENERGY USE (PJ), 2019

NATURAL GAS
538 55%

ELECTRICITY
266 27%

HEATING OIL
978 90%

WOOD
110 11%

OTHER
15 5%

TOTAL
978 PJ
COMMERCIAL AND INSTITUTIONAL ENERGY USE BY END USE, 2019

- AUXILIARY EQUIPMENT: 16%
- SPACE HEATING: 54%
- WATER HEATING: 6%
- LIGHTING: 15%
- AUXILIARY MOTORS: 4%
- SPACE COOLING: 4%
- STREET LIGHTING: 1%

TOTAL: 1,204 PJ

Commercial and institutional energy use increased between 2000 and 2019 22% but would have increased 34% without energy efficiency improvements.

Energy intensity (GJ/m²) decreased 4%.

Since 2000, energy efficiency in the commercial and institutional sector has improved 13%, saving 124 PJ of energy and $3.2 billion in energy costs in 2019.
The industrial sector includes all manufacturing, mining (including oil and gas extraction), forestry and construction activities.

From 2000 to 2019, industrial energy use increased 19%. Energy use in resource extraction industries increased nearly threefold over the same period.

Excluding resource extraction industries, energy efficiency improvements of 5% in the industrial sector resulted in savings of 137 PJ and $1.6 billion in energy costs in 2019.

* “Other” includes HFO, coke and coke oven gas, coal, LPGs, NGLs, steam and waste.
**HISTORICAL ENERGY EFFICIENCY**

- **Energy efficiency** is a measure of how effectively energy is used for a given purpose and is an important path toward decarbonization.

- **Energy intensity** is the ratio of energy use per unit of activity (such as floor space and GDP).

- **Efficiency improvements** slow the rate of growth in energy use.

- **Energy efficiency** in Canada improved by 10% between 2000 and 2019.

- **Energy use grew by 20%** between 2000 and 2019. Without energy efficiency improvements, energy use would have grown by 31%.

- **Energy efficiency savings** of 815 PJ in 2019 were equivalent to end-user savings of $23 billion.

**SECONDARY ENERGY USE WITH AND WITHOUT ENERGY EFFICIENCY EFFECT, 2000-2019**
Per capita energy consumption was 2% lower in 2019 than in 2000.

Canada used 18% less energy per dollar of GDP in 2019 than in 2000.
SUMMARY OF FACTORS INFLUENCING THE CHANGE IN ENERGY USE, 2000-2019

- **Activity**: major drivers of energy use in a sector (e.g. floor space area in the commercial/institutional sector)
- **Structure**: refers to change in the makeup of each sector
- **Service level**: increased penetration of auxiliary equipment in commercial/institutional buildings
- **Energy efficiency**: how effectively energy is being used for a given purpose. For example, providing a similar (or better) level of service with less energy consumption on a per unit basis is considered an improvement in energy efficiency.

* “Other” refers to street lighting, non-commercial airline aviation, off-road transportation and agriculture, which are included in the “Total change in energy use” column but are excluded from the factorization analysis.
TRENDS IN ENERGY USE AND INTENSITY BY SECTOR, 2000-2019

RESIDENTIAL
- Energy use: +11%
- Energy intensity: -24%

COMMERCIAL
- Energy use: +22%
- Energy intensity: -4%

TRANSPORTATION (passenger)
- Energy use: +19%
- Energy intensity: -17%

FREIGHT
- Energy use: +34%
- Energy intensity: +1%

INDUSTRIAL (forestry, mining, manufacturing, construction)
- Energy use: +19%
- Energy intensity: -4%

INDUSTRY (w/o upstream mining)
- Energy use: -11%
- Energy intensity: -22%
Section 5: Clean Power and Low Carbon Fuels

Clean technology and electricity generation mix

Renewable energy

Biofuels and transportation
CLEAN TECHNOLOGY AND THE ECONOMY

• In 2017, the Government of Canada invested in a Clean Technology Data Strategy to provide the foundation for measuring the economic, environmental and social impacts of clean technology in Canada.

• As part of this strategy, Statistics Canada has developed the Environmental and Clean Technology Products Economic Account (ECTPEA), which provides a comprehensive picture of the state of Canada’s clean technology economy for the years from 2007 to 2020.

• The ECTPEA includes processes, products and services that reduce environmental impacts through environmental protection and resource management activities and the use of goods that have been adapted to be significantly less energy- or resource-intensive than the industry standard.
Environmental and clean technology (2020):

$67.5 billion of GDP
(3.3% of total GDP)

323,000 jobs representing 1.8% of jobs in the Canadian economy

$14.3 billion in exports

Of this, clean energy alone accounted for

1.6% of Canada’s GDP

and employed 115,053 people.

The TSX and TSX-Venture exchanges list 97 companies in the cleantech sector, with a total market capitalization of $67.5 billion. Of those companies, 86 are headquartered in Canada, with a total market capitalization of $58.6 billion (as of September 30, 2022).
### ELECTRICITY
#### INTERNATIONAL CONTEXT

#### World production – 26,833 TWh (2020)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>29%</td>
</tr>
<tr>
<td>2</td>
<td>United States</td>
<td>16%</td>
</tr>
<tr>
<td>3</td>
<td>India</td>
<td>6%</td>
</tr>
<tr>
<td>4</td>
<td>Russia</td>
<td>4%</td>
</tr>
<tr>
<td>5</td>
<td>Japan</td>
<td>4%</td>
</tr>
<tr>
<td>6</td>
<td>Canada</td>
<td>2%</td>
</tr>
</tbody>
</table>

#### World exports – 741 TWh (2020)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Canada</td>
<td>9%</td>
</tr>
<tr>
<td>2</td>
<td>Germany</td>
<td>9%</td>
</tr>
<tr>
<td>3</td>
<td>France</td>
<td>9%</td>
</tr>
<tr>
<td>4</td>
<td>Sweden</td>
<td>5%</td>
</tr>
<tr>
<td>5</td>
<td>Switzerland</td>
<td>4%</td>
</tr>
</tbody>
</table>
TRADE (2021)

All Canadian electricity trade is with the U.S.

EXPORTS

60.3 TWh

IMPORTS

13.0 TWh

* includes only electricity traded under purchased contracts; excludes electricity transferred under non-financial agreements (e.g. under treaty obligations)
CANADIAN SUPPLY

GENERATION IN CANADA – 636 TWh

GENERATION BY SOURCE, 2020

- HYDRO: 60.2%
- NUCLEAR: 14.6%
- OTHER RENEWABLES: 7.8%
- GAS/OIL/OTHERS: 11.8%
- COAL: 5.7%

TOTAL: 636 TWh
PROVINCIAL ELECTRICITY GENERATION BY SOURCE, 2020

**BIOMASS**
- Canada: 1.6%
  - B.C.: 5.9%
  - N.B.: 4.8%
  - Alta.: 2.4%
  - N.S.: 2.4%
  - Ont.: 1.0%
  - Que.: 0.7%
  - P.E.I.: 0.6%
  - Man.: 0.2%
  - N.L.: 0.1%

**NATURAL GAS**
- Canada: 10.7%
  - Alta.: 55.0%
  - Sask.: 46.3%
  - N.S.: 19.7%
  - N.W.T.: 12.4%
  - Y.T.: 8.9%
  - Ont.: 6.9%
  - N.B.: 6.2%
  - B.C.: 1.4%
  - N.L.: 0.6%

**PETROLEUM**
- Canada: 1.0%
  - Nvt.: 99.4%
  - N.W.T.: 46.6%
  - N.B.: 9.0%
  - N.S.: 8.9%
  - Y.T.: 8.1%
  - N.L.: 3.0%
  - Alta.: 1.8%
  - B.C.: 1.0%
  - Que.: 0.3%
  - P.E.I.: 0.2%
  - Man.: 0.1%
  - Ont.: 0.1%

**SOLAR**
- Canada: 0.7%
  - Ont.: 2.5%
  - Y.T.: 1.1%
  - Nvt.: 0.6%
  - P.E.I.: 0.5%
  - Alta.: 0.4%
  - N.S.: 0.3%
  - N.W.T.: 0.2%
  - Sask.: 0.2%
  - Man.: 0.12%

**COAL**
- Canada: 5.7%
  - N.S.: 47.4%
  - Sask.: 32.1%
  - Alta.: 29.4%
  - N.B.: 13.9%

**OTHER**
- Canada: 0.1%
  - Alta.: 0.3%
  - Sask.: 0.3%
  - Ont.: 0.1%
# ELECTRICAL ENERGY USE

**TOTAL ELECTRICAL ENERGY USE** was 1,958.2 PJ in 2019

<table>
<thead>
<tr>
<th>Sector</th>
<th>Energy use (PJ)</th>
<th>% of the total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>620.2</td>
<td>31.7%</td>
</tr>
<tr>
<td>Commercial</td>
<td>540.1</td>
<td>27.6%</td>
</tr>
<tr>
<td>Industrial</td>
<td>755.5</td>
<td>38.6%</td>
</tr>
<tr>
<td>Transportation</td>
<td>4.4</td>
<td>0.2%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>38.0</td>
<td>1.9%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,958.2</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

*secondary energy use

**ELECTRICAL ENERGY USE BY PROVINCE, 2019**

- **Quebec (QUE.):** 37.5%
- **Ontario (ONT.):** 25.6%
- **British Columbia and Territories (B.C. and TERR.):** 12.1%
- **Manitoba (MAN.):** 3.8%
- **Alberta (ALTA.):** 10.5%
- **Atlantic provinces (ATL.*):** 6.7%
- **Saskatchewan (SASK.):** 3.9%

* Atlantic provinces
ELECTRICITY PRICES

AVERAGE LARGE INDUSTRIAL AND RESIDENTIAL ELECTRICITY PRICES* (AS OF APRIL 2022)
in cents/kWh

*including taxes
LEVELIZED COST OF ELECTRICITY

One measure used to directly compare costs between generation technologies is the levelized cost of electricity (LCOE). This is the average price an electricity generator must receive for each unit it generates over its lifetime to break even financially.

Over the past several years, various groups have conducted analysis of LCOE for energy sources in Canada, including the Canada Energy Regulator as well as the Canadian Energy Research Institute whose results are presented below. Results can vary depending on methodology, scope and inputs used.
### PERCENTAGE OF TOTAL ELECTRICITY FROM NON-EMITTING SOURCES FOR THE TOP FOUR ELECTRICITY-GENERATING COUNTRIES AND CANADA, 2020

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Canada</td>
<td>83%</td>
</tr>
<tr>
<td>2</td>
<td>Russia</td>
<td>40%</td>
</tr>
<tr>
<td>3</td>
<td>United States</td>
<td>39%</td>
</tr>
<tr>
<td>4</td>
<td>China</td>
<td>33%</td>
</tr>
<tr>
<td>5</td>
<td>India</td>
<td>24%</td>
</tr>
</tbody>
</table>

- **Renewable electricity generation** has increased 23% between 2010 and 2020, with solar and wind having the largest growth.
- In 2020, **83% of electricity in Canada** came from non-GHG emitting sources. **Hydro** made up 60%, **nuclear was 15%**, and other renewables were the remaining 8%.
GHG SPOTLIGHT: ELECTRICITY

Total electricity emissions decreased by 68% from 2000 to 2020 because of increased generation from non-emitting sources.

Coal-fired electricity generation accounted for 6% of generation and 62% of electricity-related GHG emissions in 2020.
RENEWABLE ENERGY
INTERNATIONAL CONTEXT

World production – 85,483 PJ or 2,042 MTOE (2020)

1 China 17%
2 India 11%
3 United States 9%
4 Brazil 7%
5 Nigeria 6%
...
7 Canada 2%

Share of energy supply from renewable sources (2020)

14.7% World
11.9% OECD countries only
17.3% Canada
CANADIAN PRODUCTION (2020)

Total renewable energy* – 2,090 PJ or 49,9 MTOE

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro</td>
<td>66.2%</td>
</tr>
<tr>
<td>Solid biomass (e.g. wood/waste)</td>
<td>23.2%</td>
</tr>
<tr>
<td>Wind</td>
<td>6.2%</td>
</tr>
<tr>
<td>Ethanol**</td>
<td>1.8%</td>
</tr>
<tr>
<td>Municipal waste/landfill gas</td>
<td>1.1%</td>
</tr>
<tr>
<td>Solar photovoltaic</td>
<td>0.7%</td>
</tr>
<tr>
<td>Biodiesel</td>
<td>0.6%</td>
</tr>
<tr>
<td>Solar thermal</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

*includes energy consumed for electricity and heat production and for biofuels in the transportation sector
**is a biogasoline
HYDROELECTRICITY

Moving water is the most important renewable energy source in Canada, providing 60% of Canada’s electricity generation. In fact, in 2020, Canada was the third-largest producer of hydroelectricity in the world.

INTERNATIONAL CONTEXT

World generation of hydroelectricity – 4,341 TWh (2020)

1 China 30%
2 Brazil 9%
3 Canada 9%
4 United States 7%
5 Russia 5%
HYDROELECTRICITY CAPACITY IN CANADA

MAJOR HYDRO FACILITIES IN CANADA* (≥1,000 MW)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Total capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert-Bourassa</td>
<td>5,616</td>
</tr>
<tr>
<td>Churchill Falls</td>
<td>5,428</td>
</tr>
<tr>
<td>Mica</td>
<td>2,805</td>
</tr>
<tr>
<td>La Grande 4</td>
<td>2,779</td>
</tr>
<tr>
<td>Gordon M. Shrum</td>
<td>2,730</td>
</tr>
<tr>
<td>Revelstoke</td>
<td>2,480</td>
</tr>
<tr>
<td>La Grande 3</td>
<td>2,417</td>
</tr>
<tr>
<td>La Grande 2A</td>
<td>2,106</td>
</tr>
<tr>
<td>Beaugirardois</td>
<td>1,900</td>
</tr>
<tr>
<td>Manic 5</td>
<td>1,596</td>
</tr>
<tr>
<td>Sir Adam Beck 2</td>
<td>1,499</td>
</tr>
<tr>
<td>La Grande 1</td>
<td>1,436</td>
</tr>
<tr>
<td>Limestone</td>
<td>1,340</td>
</tr>
<tr>
<td>Manic 3</td>
<td>1,326</td>
</tr>
<tr>
<td>Manic 2</td>
<td>1,229</td>
</tr>
<tr>
<td>Kettle</td>
<td>1,220</td>
</tr>
<tr>
<td>Bersimis 1</td>
<td>1,178</td>
</tr>
<tr>
<td>Manic 5 PA</td>
<td>1,064</td>
</tr>
<tr>
<td>Robert H. Saunders</td>
<td>1,045</td>
</tr>
<tr>
<td>Outardes 3</td>
<td>1,026</td>
</tr>
</tbody>
</table>

Hydroelectricity capacity in Canada was 82,307 MW in 2021.

*There are 596 facilities with a capacity of at least 1 MW and 13 facilities with less than 1 MW of capacity, for a total of 609 facilities.
BIOMASS

- Biomass is a renewable energy resource derived from living organisms and/or their by-products.
- In 2021 there were 38 operational co-generation units at pulp and paper mills and 35 Independent Power Providers (IPP) using biomass.
- Electrical capacity of pulp and paper co-generation was 1,627 MW, while heat capacity was 3,762 MW. IPP capacity for electricity and heat was 640 MW and 344 MW, respectively.
- In 2021, there were also 545 bioheat projects, where 80% of heating systems are less than 1 MW in size.

Biomass accounts for the largest share of renewable energy production in the OECD, at 33%.

In Canada, that share is

- Biomass: 23%
- Hydro: 66%
- Other Renewables: 11%
CANADIAN PRODUCTION

CANADIAN PRODUCTION OF BIOMASS, 2020

WOOD FUEL USE BY SECTOR, 2020

- **Industrial**: 53%
- **Electricity**: 20%
- **Residential**: 27%

**Total**: 419 PJ
WIND POWER

- Electricity from wind energy is one of the fastest growing sources of electricity in the world and in Canada.

- Wind accounts for 5.5% of electricity generation in Canada in 2020.

INTERNATIONAL CONTEXT

World capacity of wind power – 837,251 MW (2021)

1. China 40%
2. United States 16%
3. Germany 8%
4. India 5%
5. United Kingdom 3%
...
8. Canada 2%
WIND POWER IN CANADA

Capacity (2021):
14,304 MW
more than tripled

<3x
since 2010

Generation (2020):
35.3 TWh
quadrupled

≈4x
since 2010
CAPACITY BY PROVINCE (MW)

LARGEST WIND FARMS IN CANADA* (≥150 MW)

Canada has 317 wind energy projects producing power across the country.
**SOLAR PHOTOVOLTAIC**

- Solar power is the conversion of energy from sunlight into electricity. Solar PV is rapidly becoming an economical, renewable technology to harness renewable energy from the sun.

### INTERNATIONAL CONTEXT

**World capacity of solar PV – 942 GW** (2021)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>33%</td>
</tr>
<tr>
<td>2</td>
<td>United States</td>
<td>13%</td>
</tr>
<tr>
<td>3</td>
<td>Japan</td>
<td>8%</td>
</tr>
<tr>
<td>4</td>
<td>India</td>
<td>6%</td>
</tr>
<tr>
<td>5</td>
<td>Germany</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Canada</td>
<td>0.4%</td>
</tr>
</tbody>
</table>
SOLAR PV IN CANADA

Capacity (2020):
3,651 MW

Generation (2020):
4.5 TWh

INSTALLED CAPACITY

Cumulative
Annual additions


Megawatts
0 500 1,000 1,500 2,000 2,500 3,000 3,500

### SOME OF THE LARGEST SOLAR PV FARMS IN CANADA* (≥20 MW)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Total capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claresholm Solar project</td>
<td>100</td>
</tr>
<tr>
<td>Grand Renewable Energy Park</td>
<td>100</td>
</tr>
<tr>
<td>Sol-Luce Kingston Solar Energy Project</td>
<td>100</td>
</tr>
<tr>
<td>Kingston Project</td>
<td>80</td>
</tr>
<tr>
<td>Sarnia Solar Project</td>
<td>60</td>
</tr>
<tr>
<td>Sault Saint Marie 1-3</td>
<td>54</td>
</tr>
<tr>
<td>Loyalist Solar Project</td>
<td>50</td>
</tr>
<tr>
<td>Southgate Solar Project</td>
<td>50</td>
</tr>
<tr>
<td>Windsor Solar Project</td>
<td>47</td>
</tr>
<tr>
<td>Prairie Light 2, 3</td>
<td>44</td>
</tr>
<tr>
<td>Nanticoke Solar Project</td>
<td>40</td>
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<tr>
<td>St. Clair Moore &amp; Sombra</td>
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<tr>
<td>Cochrane Solar</td>
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<td>Liskeard 1, 3 &amp; 4 Solar Projects</td>
<td>27</td>
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<td>Stardale</td>
<td>24</td>
</tr>
<tr>
<td>Saint-Isidore</td>
<td>24</td>
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<td>Emsley Solar</td>
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<td>23</td>
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<td>Suffield Solar</td>
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<tr>
<td>Fortis 421S Hays DG PV</td>
<td>23</td>
</tr>
<tr>
<td>Fortis 275S Jenner Solar DER</td>
<td>23</td>
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<td>Innisfail Solar Project</td>
<td>22</td>
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<tr>
<td>Hydro One Brampton Commercial Solar</td>
<td>20</td>
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<tr>
<td>Amherstburg 1,2,3,4</td>
<td>20</td>
</tr>
<tr>
<td>Belmont Solar Farm</td>
<td>20</td>
</tr>
<tr>
<td>Walpole Solar Farm</td>
<td>20</td>
</tr>
<tr>
<td>Burdett Solar Project</td>
<td>20</td>
</tr>
</tbody>
</table>

*Canada has 190 major solar energy projects producing power across the country, and there are around 48,000 solar energy installations across Canada.
**URANIUM**

- Uranium is a silvery-white metal and a primary energy source. After raw uranium is mined and milled, it is processed to make fuel for nuclear reactors to generate electricity.

**INTERNATIONAL CONTEXT**

**World production – 48.3 kt (2021)**

<table>
<thead>
<tr>
<th>Country</th>
<th>Production</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Kazakhstan</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td>2 Namibia</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td><strong>3 Canada</strong></td>
<td><strong>10%</strong></td>
<td></td>
</tr>
<tr>
<td>4 Australia</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>5 Uzbekistan</td>
<td>7%</td>
<td></td>
</tr>
</tbody>
</table>

**World exports – 40.9 kt (2021)**

<table>
<thead>
<tr>
<th>Country</th>
<th>Exports</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Kazakhstan</td>
<td>53%</td>
<td></td>
</tr>
<tr>
<td>2 Namibia</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>3 Australia</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>4 Uzbekistan</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td><strong>5 Canada</strong></td>
<td><strong>8%</strong></td>
<td></td>
</tr>
</tbody>
</table>

**World known recoverable resources – 6.1 Mt (2019)**

<table>
<thead>
<tr>
<th>Country</th>
<th>Resources</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Australia</td>
<td>28%</td>
<td></td>
</tr>
<tr>
<td>2 Kazakhstan</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td><strong>3 Canada</strong></td>
<td><strong>9%</strong></td>
<td></td>
</tr>
<tr>
<td>4 Russia</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>5 Namibia</td>
<td>7%</td>
<td></td>
</tr>
</tbody>
</table>
NUCLEAR POWER

- Nuclear energy is the second largest contributor of non-emitting electricity in Canada. In 2020, nuclear energy provided approximately 15% of Canada’s total electricity needs (close to 60% in Ontario).

INTERNATIONAL CONTEXT

World generation – 2,653 TWh (2021)

1 United States 29%
2 China 14%
3 France 14%
4 Russia 8%
5 South Korea 6%
6 Canada 3%
**CANADIAN SUPPLY AND DEMAND (2021)**

**URANIUM**

Canadian production **4.7 kt**

All uranium comes from mines in Saskatchewan.

**VALUED AT**

about **$500 million**

69% of production was available for export.

Based on long-term contracts*, uranium sold by Canada is destined for:

1) North America/Latin America  52%
2) Asia  27%
3) Europe  21%

* These values can vary based on changes in regional demand.

15% of uranium purchased by U.S. nuclear reactors in 2021 came from Canada, making Canada the largest foreign supplier of uranium to the U.S.

**DOMESTIC USE: 31%** of production

Used in Canada’s CANDU reactors (Ontario and New Brunswick), including the Bruce Generating Station, amongst the world’s largest operating nuclear facilities.
Across the country, nuclear power is generated from uranium that has been mined, milled and processed.

Based on installed capacity, the Bruce Nuclear Generating Station is amongst the largest nuclear power plants in the world.
CANDU NUCLEAR REACTORS

- **Canada has developed a unique nuclear reactor technology called CANDU**, for CANada Deuterium Uranium. Canada is one of roughly half a dozen countries that offer domestically designed reactors to the open commercial market.

- The CANDU reactor is a pressurized heavy water reactor (PHWR) that uses heavy water (deuterium oxide) as a moderator and coolant and natural uranium for fuel. The majority of power reactors in use in the world are light water reactors (LWR), which use normal water as the moderator and coolant and enriched uranium for fuel.

- **CANDU technology continues to evolve to enable the use of alternative fuels.** Work is underway in Chinese CANDU reactors to demonstrate that they can recycle used fuel from other nuclear power plants, reducing the volume of nuclear waste.

11 CANDU reactors are in operation outside of Canada.
GROSS ELECTRICAL OUTPUT OF NUCLEAR POWER PLANTS IN CANADA

<table>
<thead>
<tr>
<th>Facility</th>
<th>Province</th>
<th>Gross Electrical Output (MW)</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Darlington</td>
<td>Ontario</td>
<td>3,736</td>
<td>4</td>
</tr>
<tr>
<td>Bruce B</td>
<td>Ontario</td>
<td>3,507</td>
<td>4</td>
</tr>
<tr>
<td>Bruce A</td>
<td>Ontario</td>
<td>3,437</td>
<td>4</td>
</tr>
<tr>
<td>Pickering B</td>
<td>Ontario</td>
<td>2,160</td>
<td>4</td>
</tr>
<tr>
<td>Pickering A</td>
<td>Ontario</td>
<td>1,084</td>
<td>2</td>
</tr>
<tr>
<td>Point Lepreau</td>
<td>New Brunswick</td>
<td>705</td>
<td>1</td>
</tr>
</tbody>
</table>

URANIUM - PRICES*

* The majority of Canadian uranium production is sold by long-term contract, as opposed to the on the spot market.
LIQUID BIOFUELS

- Liquid biofuels are enhanced biomass-derived fuels that can take the form of a liquid such as ethanol or renewable diesel fuels. The liquid biofuels are mixed with traditional gasoline and diesel to reduce the overall GHG emissions associated with the blended fuel.

- The federal *Renewable Fuels Regulations* require fuel producers and importers to have an average renewable content of at least 5% based on the *volume of gasoline* that they produce or import and at least 2% of the *volume of diesel fuel* that they produce and import.*

* Heating distillate oil volumes for space-heating purposes are excluded from the diesel regulations.

---

INTERNATIONAL CONTEXT

**World capacity of biofuels – 151 billion litres**

(2020)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>United States</td>
<td>40%</td>
</tr>
<tr>
<td>2</td>
<td>Brazil</td>
<td>27%</td>
</tr>
<tr>
<td>3</td>
<td>European Union</td>
<td>12%</td>
</tr>
<tr>
<td>4</td>
<td>Indonesia</td>
<td>5%</td>
</tr>
<tr>
<td>5</td>
<td>China</td>
<td>3%</td>
</tr>
<tr>
<td>8</td>
<td>Canada</td>
<td>1%</td>
</tr>
</tbody>
</table>

...
WORLD BIOFUELS PRODUCTION

CANADIAN SUPPLY AND DEMAND (2021) (MB/D [MILLION L])

Canadian production
- Ethanol: 28.3 (1,642) Billion Litres
- Biodiesel: 7.2 (416) Billion Litres

Exports
- Ethanol: 1.9 (108) Million Litres
- Biodiesel: 7.6 (440) Million Litres

Imports
- Ethanol: 21.6 (1,254) Million Litres
- Biodiesel: 9.9 (573) Million Litres

Domestic demand
- Ethanol: 50.8 (2,946) Billion Litres
- Biodiesel: 13.7 (796) Billion Litres
CANADIAN BIOFUEL PRODUCTION

- Liquid biofuels are made of feedstocks such as cereal grains and vegetable oils.
- In 2021, 4.4 million tonnes of cereal grain, and 340 thousand tonnes of vegetable oil were used in domestic production of biofuels.
- Canada produced 1.6 billion liters of fuel ethanol and 420 million liters of biodiesel and other products in 2021.
- Co-products are secondary goods that are generated during the biofuel manufacturing process and can be sold or reused. Biofuel production generated 1.8 million tonnes of co-products in 2021, primary distillers grains which can be used as animal feed.
Currently the majority of liquid biofuels in Canada are produced in southern Ontario and Saskatchewan.
Total transportation energy use increased 30% from 2000 to 2019.

Energy efficiency improvements in the transportation sector saved Canadians 489 PJ of energy and over $14 billion in energy costs in 2019.

Passenger transportation contributes 53% to the total emissions, freight emissions are 43%, and off-road emissions are 4%.

* The ethanol proportion is estimated based on production data.
** The category “Other” includes electricity, natural gas, biodiesel fuel oil, light fuel oil, aviation gasoline and propane.
In 2021, electric vehicle (EV) registrations made up **5.2% of total vehicle registrations**.

Over **86,000 plug-in EVs** were **registered** in 2021, over four times the number of registrations as in 2017. Sales are highest in the provinces of Quebec, British Columbia and Ontario.
• **Transportation GHG emissions decreased** 14% from 2019 to 2020 largely due to impacts caused by the pandemic. Generally, emissions from passenger light trucks and freight trucks have continued to rise because of an increased number of vehicles (especially light trucks and SUVs). Freight emissions have increased because of many factors including increasing trade and globalization and online shopping.
HYDROGEN

Hydrogen is a versatile, carbon-free energy carrier that can be produced from a variety of feedstocks. Hydrogen can be converted to electricity through a fuel-cell in electric vehicles and power generation equipment, combusted to produce heat, or used as a feedstock in a range of chemical and industrial processes.

DID YOU KNOW?

The energy in 1 kg of hydrogen is the same as approximately 2.8 kg of gasoline.
The total global production of hydrogen in 2020 was **90 million tonnes (Mt)**, in which **79%** of production was deliberate, and **21%** was produced as a by-product to industrial processes.

Global demand for hydrogen in 2020 was of **90 Mt**. Hydrogen for oil refining and ammonia production were the most common end-uses, accounting for approximately **44%** and **38%** of total demand, respectively.
• Canada is one of the top 10 hydrogen producers in the world today, with an estimated 3 Mt of hydrogen produced per year.

• Most hydrogen in Canada is produced from natural gas and used by the chemical industry and the oil and gas sector. While most is currently produced without CCS technology (grey hydrogen), there are also several fossil-fuel based hydrogen with CCS (blue hydrogen) production projects and renewable-fueled (green hydrogen) hydrogen production facilities operating in Canada and under development.

• As of 2017, there were more than 100 established hydrogen and fuel cell companies spanning the full value chain, employing more than 2,100 people in direct jobs within Canada, and generating revenues in excess of $200 million and investing $91 million in RD&D.

• Canadian heavy-duty fuel cell engine technology powers more than half of worldwide fuel cell electric buses in revenue service in a range of international markets.
Section 6: Oil, natural gas and coal

- Crude oil
- Natural gas
- Hydrocarbon gas liquids (HGLs)
- Refined petroleum products (RPPs)
- Coal
- GHG Emissions from petroleum
PETROLEUM AND THE ECONOMY

NOMINAL GDP CONTRIBUTION FOR CANADA, 2021

NOMINAL GDP (% OF CURRENT DOLLARS)

7.2%
or
$168.2 billion

CANADIAN GDP
PETROLEUM DIRECT
5.7% ($133.1 BILLION)

PETROLEUM INDIRECT
1.5% ($35.1 BILLION)

EMPLOYMENT, 2021

DIRECT: 163,700 JOBS

OIL AND GAS EXTRACTION: 54,400
SUPPORT ACTIVITIES: 58,300
EXPLORATION: 7,700
NATURAL GAS TRANSMISSION AND DISTRIBUTION: 13,100
CRUDE OIL PIPELINES: 4,000
OTHER: 26,100

INDIRECT: 278,400 JOBS

TOTAL: 442,100 JOBS

• Capital Expenditures (2021): $42 billion
• Canada’s oil and gas sector represents about 27% of the country’s GHG emissions.
• Exports (2021): $140 billion (29% of total exports)

Approximately 10,400 Indigenous people are employed in the oil and gas sector.

4TH Largest oil producer globally
5TH Largest gas producer globally

Parts may not sum to total due to rounding. The indirect contribution is not comparable to previously published estimates due to revisions and a change in estimation methodology by Statistics Canada. For more information on Statistics Canada's estimation methodology, please contact statcan.iadinfoddci-dciinfoiad.statcan@statcan.gc.ca.
While Canada’s petroleum sector directly employed 163.7K people in 2021, the sector’s use of inputs from other industries created an additional 278K indirect jobs in the supply chain.

Alberta employed the majority (54%) of the supply chain workers followed by BC (15%). Ontario (13%) and Quebec (6%) also accounted for sizeable shares of supply chain jobs.
PETROLEUM EMPLOYMENT
(Thousands of jobs)

Parts may not sum to total due to rounding. The indirect contribution is not comparable to previously published estimates due to revisions and a change in estimation methodology by Statistics Canada. For more information on Statistics Canada’s estimation methodology, please contact statcan.iadodcdci-dcioidstatcan@statcan.gc.ca.
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# CRUDE OIL
## INTERNATIONAL CONTEXT

**World production** – 83.7 MMb/d *(2021)*

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>United States</td>
<td>17%</td>
</tr>
<tr>
<td>2</td>
<td>Russia</td>
<td>12%</td>
</tr>
<tr>
<td>3</td>
<td>Saudi Arabia</td>
<td>12%</td>
</tr>
<tr>
<td>4</td>
<td>Canada</td>
<td>7%</td>
</tr>
<tr>
<td>5</td>
<td>Iraq</td>
<td>5%</td>
</tr>
</tbody>
</table>

**World exports** – 43.5 MMb/d *(2020)*

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Saudi Arabia</td>
<td>15%</td>
</tr>
<tr>
<td>2</td>
<td>Russia</td>
<td>11%</td>
</tr>
<tr>
<td>3</td>
<td>Canada</td>
<td>9%</td>
</tr>
<tr>
<td>4</td>
<td>United States</td>
<td>8%</td>
</tr>
<tr>
<td>5</td>
<td>Iraq</td>
<td>8%</td>
</tr>
</tbody>
</table>

* includes crude oil, NGLs, additives and other hydrocarbons (including the receipts of additives).
World proved reserves
1,725.5 billion barrels
(at the end of 2021)

97% of Canada’s proven oil reserves are located in the oil sands.

Proved reserves are those reserves expected to be recoverable with a high degree of certainty.

*Saudi Arabia and Kuwait reserves include the Saudi-Kuwaiti “neutral zone,” with total proved reserves of 5 billion barrels.

Venezuela 18%
Iran 12%
Other 8%
Canada 37%
Saudi Arabia* 15%
Iraq 10%
**CANADIAN RESOURCES**

**REMAINING ESTABLISHED RESERVES***
(billion barrels, as of December 2020)

| Oil sands*** | 161 |
| Conventional** | 5.7 |
| Total | 166.7 |

* Reserves known to exist and recoverable under current technological and economic conditions.

** Reserves also include proved reserves of pentanes plus (a crude-oil equivalent that is associated with oil production).

***With improved technology, it is estimated that 315 billion barrels are ultimately recoverable from the oil sands.

### OIL WELLS COMPLETED AND AVERAGE METRES DRILLED IN WESTERN CANADA

<table>
<thead>
<tr>
<th>Year</th>
<th>Oil wells completed</th>
<th>Average metres drilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>1500</td>
<td>2000</td>
</tr>
<tr>
<td>2006</td>
<td>1700</td>
<td>2500</td>
</tr>
<tr>
<td>2007</td>
<td>1900</td>
<td>3000</td>
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<td>2008</td>
<td>2100</td>
<td>3500</td>
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<td>2009</td>
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<td>2014</td>
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<td>4300</td>
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<tr>
<td>2020</td>
<td>4500</td>
<td>9500</td>
</tr>
<tr>
<td>2021</td>
<td>4700</td>
<td>10000</td>
</tr>
</tbody>
</table>

**Canada total**

**Oil wells completed and average metres drilled in Western Canada.**

**Wells completed**

**Average metres drilled**

**Canada total**

**Oil wells completed and average metres drilled in Western Canada.**

**Wells completed**

**Average metres drilled**
CANADIAN PRODUCTION

Oil sands production has exceeded conventional production since 2010.

In 2021, oil sands production was 3.1 MMb/d compared with 1.6 MMb/d of other oil production.

PRODUCTION BY TYPE

- Oil sands
- Conventional, offshore and tight oil

PRODUCTION BY PROVINCE, 2021

- Alberta: 82.4%
- Saskatchewan: 10.4%
- Newfoundland and Labrador: 6.0%
- Manitoba: 0.8%
- British Columbia: 0.3%
- Other*: 0.1%

*Other: Nova Scotia, Ontario and the Northwest Territories.
CANADIAN SUPPLY AND DEMAND* (2021)

Canadian production: 4.7 MMb/d
Exports: 3.8 MMb/d
Imports: 0.7 MMb/d

TRADE

CANADIAN TRADE OF CRUDE OIL

CRUDE OIL INPUT TO DOMESTIC REFINERIES

* includes condensates and pentanes plus.
OIL SANDS
An estimated $340 billion of capital investment to date, including $7.7 billion in 2021

BITUMEN UPGRADING
- Crude bitumen from oil sands may be transported to upgraders for processing to make it lighter – “synthetic crude oil.”
- In 2021, 39% of the raw bitumen produced was sent for upgrading in Alberta.
- Major companies with upgrading capacity include Syncrude, Suncor, Shell, Canadian Natural Resources, Husky and Nexen-CNOOC.
- The total upgrading capacity in Canada is 1.15 MMb/d
- Bitumen may also be blended with diluent (e.g. condensates) and sold directly to refineries capable of processing heavier oils.
MINING METHOD

**Process:** Companies use trucks and shovels to scoop oil sands from the ground. The oil sands are then transported to extraction plants where bitumen is separated from the sand by using steam. Tailings are then pumped into settling basins.

In 2021, **seven projects in Alberta** produced **1,595 Mb/d**: Syncrude Mining Project (**350 Mb/d**), Suncor Base Mine (**276 Mb/d**), CNRL Horizon Mine (**260 Mb/d**), Athabasca Oil Sands Project – Muskeg River (**183 Mb/d**), Jackpine Mine (**148 Mb/d**), Imperial’s Kearl Mine (**281 Mb/d**) and Fort Hills (**97 Mb/d**).
IN SITU METHOD

**Process:** Companies drill vertical and/or horizontal wells to inject steam to facilitate the flow of oil.

**More than 20 projects in Alberta** – The largest projects in 2021 were Firebag and MacKay River (Suncor) at 242 Mb/d, Christina Lake (Cenovus) at 236 Mb/d, Foster Creek (Cenovus) at 175 Mb/d and Cold Lake (Imperial Oil) at 141 Mb/d.
In 2021, imports of crude oil into Canada came from a range of countries including:

- **66%** U.S.
- **15%** Saudi Arabia
- **13%** Nigeria
- **2%** Azerbaijan
- **2%** Colombia

Over recent years, the U.S. has become Canada’s primary supplier of imported crude oil.

In 2021, Canada was the largest foreign supplier of crude oil to the U.S., accounting for

- **62%** of total U.S. crude oil imports
- **25%** of U.S. refinery crude oil intake
- **98%** of all Canadian crude oil exports

exchanged

3.7MMb/d to
PRICES

WEST TEXAS INTERMEDIATE (WTI)

- Reference price for light crude oil delivered at Cushing, Oklahoma (a major pipeline hub)
- Used as the benchmark price for North American crudes and underlies oil futures contracts on the NYMEX

WESTERN CANADIAN SELECT (WCS)

- WCS is the main benchmark price for Canadian heavy crude, specifies delivery at Hardisty, Alberta and is representative of the price of oil from the oil sands.

WTI-WCS DIFFERENTIAL

- WCS is typically sold at a discount to WTI due to differences in quality and transportation costs. Heavy crude is more difficult to process and requires specialized equipment at refineries.
- The WCS-WTI differential has historically averaged between US$10-$15 per barrel. However, during the fall of 2018, the differential reached a record high of over US$50 per barrel due to insufficient pipeline capacity.
- In Q2 2020, oil prices collapsed due to the drop in demand resulting from government-imposed lockdowns to limit the spread of Covid-19. US refineries drastically reduced their refinery runs and purchases of Canadian heavy crude.
- Beginning in Q3 2020, demand recovered as lockdown measures were eased. This resulted in a large price rebound that continued throughout 2021 and into 2022.
MAJOR CER REGULATED OIL PIPELINES
CRUDE BY RAIL

In 2018, as production increases in Western Canada began to outpace pipeline capacity, shipments of crude oil by rail increased to fill the gap, more than doubling from their 2017 levels.

Amidst the economic disruption beginning in Q1 2020, crude shipments surged beyond their 2019 peak, reaching a high of 412 Mb/d in February 2020. This upswing was promptly reversed in Q2, when shipments fell sharply. After bottoming-out at a four year low in July 2020, volumes have started to recover.

Domestic rail shipments of fuel oils and crude petroleum are relatively stable compared to volumes of crude oil exports by rail.
OIL SANDS: ENVIRONMENTAL CONSIDERATIONS

WATER

Mining method:

**2.9 barrels**

In situ method: an average of **0.2 barrels**

Oil sands producers recycle about **73%** of the water used for established mines.

88% of the water used for in situ production is recycled.
GREENHOUSE GASES

12% of Canada’s total GHG emissions and 0.17% of global emissions

From 2000 to 2020, emissions intensity per barrel decreased by

as a result of technological and efficiency improvements, fewer venting emissions and reductions in the percentage of crude bitumen being upgraded to synthetic crude oil.
NATURAL GAS
INTERNATIONAL CONTEXT

World production – 401 Bcf/d (11.4 Bcm/d)
(2021, PRELIMINARY)

1 United States 23%
2 Russia 19%
3 Iran 6%
4 China 5%
5 Canada 5%

World exports – 124 Bcf/d (3.5 Bcm/d)
(2021, PRELIMINARY)

1 Russia 19%
2 United States 15%
3 Qatar 10%
4 Norway 9%
5 Australia 8%
6 Canada 6%
### World proved reserves – 7,291 Tcf (206 Tcm) (BEGINNING OF 2021)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Russia</td>
<td>23%</td>
</tr>
<tr>
<td>2</td>
<td>Iran</td>
<td>16%</td>
</tr>
<tr>
<td>3</td>
<td>Qatar</td>
<td>12%</td>
</tr>
<tr>
<td>4</td>
<td>United States</td>
<td>6%</td>
</tr>
<tr>
<td>5</td>
<td>Turkmenistan</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>...</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Canada</td>
<td>1%</td>
</tr>
</tbody>
</table>

### World unproved technically recoverable shale resources – 7,577 Tcf (2015)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>15%</td>
</tr>
<tr>
<td>2</td>
<td>Argentina</td>
<td>11%</td>
</tr>
<tr>
<td>3</td>
<td>Algeria</td>
<td>9%</td>
</tr>
<tr>
<td>4</td>
<td>United States</td>
<td>8%</td>
</tr>
<tr>
<td>5</td>
<td>Canada</td>
<td>8%</td>
</tr>
</tbody>
</table>
CANADA-U.S. RESOURCES

PROVED RESERVES* (End 2020/Beginning 2021)

73 Tcf

465 Tcf

TOTAL 539 Tcf

MARKETABLE/TECHNICALLY RECOVERABLE RESOURCES**

Canada total, year-end 2020 1,373 Tcf
  conventional 380 Tcf
  unconventional 993 Tcf
    (coal-bed methane, shale and tight gas)

U.S. total, year-end 2019 2,926 Tcf
  portion that is shale and tight gas 2,031 Tcf
  portion that is other 895 Tcf

World total (year-end 2020) 28,146 Tcf
  conventional 15,009 Tcf
  unconventional 13,137 Tcf

* Proved reserves are known to exist and are recoverable under current technological and economic conditions.

** Canadian marketable resources: natural gas that is in a marketable condition, after the removal of impurities and after accounting for any volumes used to fuel surface facilities. Marketable resources are recoverable using existing technologies, based on geological information, but much of the drilling necessary to produce the natural gas has not yet been performed.

U.S. technically recoverable resources: gas estimated to be recoverable as drilling and infrastructure expands (similar to Canadian marketable resources)
CANADA-U.S. MARKET (2021)

Canada’s natural gas market is heavily integrated with that of the U.S. largely because of the location of supply basins, demand centres, and the availability of transportation infrastructure, as well as existing Canada-U.S. trade agreements. These factors allow for consumers and distributors on either side of the border to freely access natural gas from the lowest cost supplier.

**Canadian average marketable production**

- **16.8 Bcf/d (0.48 Bcm/d)**
  - 13% conventional
  - 87% unconventional*

**U.S. average marketable production**

- **93.5 Bcf/d (2.59 Bcm/d)**
  - 11% conventional
  - 89% unconventional*

* Unconventional gas includes tight gas, coal bed methane and shale gas.

**Canada-U.S. production**

110.3 Bcf/d (3.12 Bcm/d)

**LNG imports of North American countries**

- **0.07 Bcf/d**
- **0.08 Bcf/d**
- **0.06 Bcf/d**

**LNG exports of North American countries**

- **9.76 Bcf/d**
While Canadian natural gas production remained relatively flat and the number of wells drilled declined, the well productivity has increased over time. This reflects the increased use of horizontal drilling and increased well length.
**CANADIAN AND U.S. MARKETABLE PRODUCTION OF NATURAL GAS**

![Graph showing the marketable production of natural gas for Canada and the United States from 2009 to 2021. The graph indicates a general increase in production over the years, with Canada consistently producing more than the United States.](image)

**MARKETABLE PRODUCTION BY PROVINCE, 2021**

- **B.C.**: 30.4%
- **TOTAL**: 16.8 Bcf/d (0.47 Bcm/d)
- **OTHER**: 0.2%
- **SASK.**: 1.2%
- **ALTA.**: 68.2%

**CANADIAN TRADE OF NATURAL GAS**

- **Exports**: 7.7 Bcf/d (0.22 Bcm/d)
- **Imports**: 2.3 Bcf/d (0.07 Bcm/d)

- **Canadian exports to the U.S.**: 2.3 Bcf/d (0.07 Bcm/d)
- **Canadian imports from the U.S.**: 7.7 Bcf/d (0.22 Bcm/d)
• Natural gas imports from the U.S. into Eastern Canada are on the rise because of higher supplies in the U.S. Northeast and shorter transportation distances from these U.S. natural gas basins.

• Canadian natural gas exports to the western U.S. and U.S. Midwest remain significant.

• Since 2009, Canada has also imported small amounts of liquefied natural gas from other countries through the Canaport LNG terminal in Saint John, N.B.

46% of Canadian production is exported.

Canadian exports are largely destined for the U.S.

99% of U.S. imports and 9% of U.S. consumption comes from Canada.

The value of Canadian net exports (exports minus imports) was $9.6 billion in 2021.

97% of Canada’s imports and 20% of Canadian consumption comes from the U.S.

20% of Canadian consumption comes from the U.S.
UPSTREAM PRICES

The AECO hub is Canada’s largest natural gas trading hub, and the AECO price serves as a benchmark for Alberta wholesale natural gas transactions.

**AECO PRICE**

Average: 2016        **$2.18/MMbtu**
Average: 2017        **$2.20/MMbtu**
Average: 2018        **$1.54/MMbtu**
Average: 2019        **$1.80/MMbtu**
Average: 2020        **$2.19/MMbtu**
Average: 2021        **$3.39/MMbtu**

**MONTHLY AVERAGE NATURAL GAS SPOT PRICES**

- **2013–2014 Polar Vortex**
- **Start of the North American shale gas revolution**
- **Russian invasion of Ukraine**
### NATURAL GAS ENERGY USE

#### NATURAL GAS END USE BY SECTOR, 2019

<table>
<thead>
<tr>
<th>Sector</th>
<th>Energy use (PJ)</th>
<th>Energy use (Bcf/d)</th>
<th>% of the total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>731.1</td>
<td>1.81</td>
<td>24.3%</td>
</tr>
<tr>
<td>Commercial</td>
<td>599.8</td>
<td>1.49</td>
<td>20.0%</td>
</tr>
<tr>
<td>Industrial</td>
<td>1,627.4</td>
<td>4.03</td>
<td>54.1%</td>
</tr>
<tr>
<td>Transportation</td>
<td>4.9</td>
<td>0.01</td>
<td>0.2%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>43.4</td>
<td>0.11</td>
<td>1.4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,006.6</strong></td>
<td><strong>7.45</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

#### NATURAL GAS ENERGY USE BY PROVINCE, 2019

- **ALTA.** 44.3%
- **B.C. AND TERR.** 8.1%
- **ONT.** 29.8%
- **QUE.** 8.3%
- **SASK.** 5.7%
- **MAN.** 2.5%
- **TOTAL** 3,007 PJ

* Atlantic provinces
SPOTLIGHT: OIL AND GAS

GHG emissions from oil and gas production have gone up 15% between 2000 and 2020, largely from increased oil sands production, particularly in situ extraction.

During this period, oil sands production emissions more than tripled while conventional oil and natural gas emissions decreased by 26%.
HYDROCARBON GAS LIQUIDS (HGLs)
SUPPLY AND DEMAND* (2021)

Canadian production

- **Propane**: 727.7 Mb/d
- **Butane**: 299.4 Mb/d
- **Ethane**: 206.4 Mb/d
- **221.9 Mb/d**

Exports: 254.0 Mb/d
Imports: 97.1 Mb/d

* excludes condensates and pentanes plus, which are included as part of crude oil, and includes refinery-produced LPGs.

GAS PROCESSING PLANT PRODUCTION OF NGLS BY PROVINCE (2020)

- **SASK.**: 1%
- **ALTA.**: 86%
- **B.C.**: 13%

TOTAL: 662 Mb/d
NATURAL GAS LIQUIDS ENERGY USE

TOTAL NATURAL GAS LIQUIDS ENERGY USE WAS 149.5 PJ IN 2019.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Energy use* (PJ)</th>
<th>% of the total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>16.3</td>
<td>10.9%</td>
</tr>
<tr>
<td>Commercial</td>
<td>38.8</td>
<td>25.6%</td>
</tr>
<tr>
<td>Industrial</td>
<td>72.9</td>
<td>48.8%</td>
</tr>
<tr>
<td>Transportation</td>
<td>11.6</td>
<td>7.8%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>10.5</td>
<td>7.0%</td>
</tr>
<tr>
<td>Total</td>
<td>149.5</td>
<td>100%</td>
</tr>
</tbody>
</table>

*secondary energy use

NATURAL GAS LIQUIDS ENERGY USE BY PROVINCE, 2019

- ALTA. 7.4% 41.7%
- ATL. 4.9%
- QUE. 12.5%
- ONT. 25.3%
- SASK. 5.2%
- MAN. 3.1%
- B.C. AND TERR. 7.4%

TOTAL 150 PJ
REFINED PETROLEUM PRODUCTS (RPPs)

PETROLEUM REFINERIES

Petroleum refineries transform crude oil into a wide range of refined petroleum products (RPPs, e.g. gasoline, diesel). Other facilities such as asphalt plants, lubricant plants, upgraders and some petrochemical plants also process crude oil to produce a limited range of products.

REFINERY ACTIVITIES

• crude oil distillation: separating products from crude oil by heating
• additional processing: e.g. catalytic cracking, reforming, coking
• product blending: end-use RPPs are usually blended with additives or renewable fuels

REFINERY OUTPUTS

• transportation fuels: gasoline, diesel, aviation fuels, heavy fuel oil
• heating oil
• liquid petroleum gases: propane and butane from refineries
• petrochemical feedstock
• other products: e.g. kerosene, lubricating oils, greases, waxes, asphalt
SUPPLY AND DEMAND* (2021)

Canadian net production: 1.9 MMb/d (111 billion L)

Exports: 0.3 MMb/d (17 billion L)
Imports: 0.1 MMb/d (9 billion L)

_CRUDE OIL SHIPPED TO DOMESTIC REFINERIES_

1.7 MMb/d (96 billion L)

_DOMESTIC CONSUMPTION BY PRODUCT_*

- MOTOR GASOLINE: 43%
- DISTILLATE FUELS: 32%
- PETROLEUM COKE: 3%
- RESIDUAL FUEL OIL: 3%
- ASPHALT: 3%
- KEROSENE-TYPE JET FUEL: 4%
- STILL GAS: 8%
- OTHER PRODUCTS: 2%

* Certain product shares are based on Natural Resources Canada estimates.
Primarily motor gasoline, diesel, jet fuel, fuel oil, and kerosene

16% of Canadian production of refined petroleum products is exported

88% of the dollar value of Canadian refined petroleum products exports are to the United States.

9% of the dollar value of Canadian refined petroleum products exports are to the United States.

52% of total Canadian consumption is imported.

In value terms:

- 52% United States
- 15% Netherlands
- 5% Belgium
- 4% Norway
- 4% United Kingdom

25% of United States imports come from Canada.
RETAIL PRICES

AVERAGE CANADIAN REGULAR GASOLINE PRICES, 2021

- Canada
- Vancouver
- Calgary
- Toronto
- Montreal
- Halifax

Cents per litre (cpl)

- Taxes
- Marketing Margin
- Refining Margin
- Crude Costs

[Bar chart showing average Canadian regular gasoline prices for different cities in 2021, with breaks down into components such as taxes, marketing margin, refining margin, and crude costs.]
## Refinery Capacity

### Canadian Petroleum Refineries by Count and Capacity*, 2021

<table>
<thead>
<tr>
<th>Province</th>
<th>Petroleum refinery</th>
<th>Asphalt plants</th>
<th>Lubricant plants (using crude oil as feedstock)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Capacity</td>
<td>Count</td>
<td>Capacity</td>
</tr>
<tr>
<td>Alberta</td>
<td>4</td>
<td>530</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>British Columbia</td>
<td>2</td>
<td>67</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>1</td>
<td>300</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Newfoundland and Labrador</td>
<td>1</td>
<td>130</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ontario</td>
<td>4</td>
<td>393</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Quebec</td>
<td>2</td>
<td>372</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>1</td>
<td>135</td>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15</td>
<td>1,927</td>
<td>2</td>
<td>52</td>
</tr>
</tbody>
</table>

*Capacities are in Mb/d.
## COAL

### INTERNATIONAL CONTEXT

#### World proved reserves – 1,074 BILLION TONNES (2020)

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 United States</td>
<td>23%</td>
</tr>
<tr>
<td>2 Russia</td>
<td>15%</td>
</tr>
<tr>
<td>3 Australia</td>
<td>14%</td>
</tr>
<tr>
<td>4 China</td>
<td>13%</td>
</tr>
<tr>
<td>5 India</td>
<td>10%</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>16 Canada</td>
<td>1%</td>
</tr>
</tbody>
</table>

#### World production – 7.7 BILLION TONNES (2021)

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 China</td>
<td>49%</td>
</tr>
<tr>
<td>2 India</td>
<td>11%</td>
</tr>
<tr>
<td>3 Indonesia</td>
<td>7%</td>
</tr>
<tr>
<td>4 United States</td>
<td>7%</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>14 Canada</td>
<td>1%</td>
</tr>
</tbody>
</table>

#### World exports – 1.3 BILLION TONNES (2021)

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Indonesia</td>
<td>33%</td>
</tr>
<tr>
<td>2 Australia</td>
<td>28%</td>
</tr>
<tr>
<td>3 Russia</td>
<td>16%</td>
</tr>
<tr>
<td>4 United States</td>
<td>6%</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>7 Canada</td>
<td>2%</td>
</tr>
</tbody>
</table>
PRODUCTION AND USE

Canada produced

57% is METALLURGICAL COAL used for steel manufacturing

46 Mt of coal in 2020, of which

43% is THERMAL COAL used for electricity

Electricity generation consumed

20 Mt of coal in 2020, a decrease from 43.7 Mt in 2010.

54%

COAL PRODUCTION BY PROVINCE, 2020

B.C. 53%

ALTA. 31%

TOTAL 46 Mt

N.S. 0.4%

SASK. 16%

COAL-FIRED ELECTRICITY GENERATION BY PROVINCE, 2020

ALTA. 62%

SASK. 22%

TOTAL 35.9 TWh

N.B. 3%

N.S. 12%
DOMESTIC DEMAND

Mostly for electricity generation in Alberta and Saskatchewan

Also for metallurgical applications

TRADE

CANADIAN TRADE OF COAL

Canada’s exports are primarily metallurgical coal (88% in 2020).
TRADE (2021)

**EXPORTS**
- 32 Mt

**IMPORTS**
- 6 Mt

**major export destinations** (by % value)
- $7.7 billion

**46% China**
- 15% South Korea
- 15% Japan

3% of Canadian exports are to the U.S., representing 19% of U.S. coal imports.

72% of Canadian imports are from the U.S.
ANNEX 1: UNITS AND CONVERSION FACTORS
PREFIXES AND EQUIVALENTS

<table>
<thead>
<tr>
<th>Prefix</th>
<th>SI/Metric</th>
<th>Imperial</th>
<th>Equivalent</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>k</td>
<td>kilo</td>
<td>M</td>
<td>thousand</td>
<td>$10^3$</td>
</tr>
<tr>
<td>M</td>
<td>mega</td>
<td>MM</td>
<td>million</td>
<td>$10^6$</td>
</tr>
<tr>
<td>G</td>
<td>giga</td>
<td>B</td>
<td>billion</td>
<td>$10^9$</td>
</tr>
<tr>
<td>T</td>
<td>tera</td>
<td>T</td>
<td>trillion</td>
<td>$10^{12}$</td>
</tr>
<tr>
<td>P</td>
<td>peta</td>
<td>-</td>
<td>quadrillion</td>
<td>$10^{15}$</td>
</tr>
</tbody>
</table>

Notes

- Tonne may be abbreviated to “t” and is not to be confused with “T” for tera or trillion.
- Roman numerals are sometimes used with imperial units (this can create confusion with the metric “M”).
CRUDE OIL

Upstream
- reserves usually in barrels or multiples (million barrels)
- production/capacity often in barrels per day or multiples (thousand barrels/day or Mb/d, million barrels/day or MMb/d)
- metric: 1 cubic metre = 6.2898 barrels
- International Energy Agency: uses weight (tonnes) rather than volume

Downstream (petroleum products)
- volumes of refined products usually in litres
- 1,000 litres = 1 cubic metre
- U.S.: 1 U.S. gallon = 3.785 litres

NATURAL GAS

Volume
- reserves/production usually in cubic feet or multiples (billion cubic feet or Bcf, trillion cubic feet or Tcf)
- production/capacity often in cubic feet per day or multiples (Bcf/d, Tcf/d)
- metric: 1 cubic metre = 35.3147 cubic feet

Density
- 1 million t LNG = 48.0279 billion cubic feet

Pricing
Volume-based:
- cents per cubic metre (¢/m³) (customer level in Canada)
- $ per hundred cubic feet ($/CCF) (customer level in the U.S.)

Energy content-based:
- $ per gigajoule ($/GJ) (company level in Canada)
- $ per million British thermal units ($/MMbtu) (company level in the U.S., LNG)

URANIUM
- 1 metric tonne = 1,000 kilograms of uranium metal (U)
- U.S.: in pounds of uranium oxide (U₃O₈)
- 1 lb. U₃O₈ = 0.84802 lb. U = 0.38465 kg U

COAL
- 1 metric tonne = 1,000 kilograms
- U.S.: 1 short ton = 2,000 pounds
- 1 metric tonne = 1.10231 short tons

ELECTRICITY

Capacity
- maximum rated output that can be supplied at an instant, commonly expressed in megawatts (MW)

Total capacity
- installed generator nameplate capacity

Generation/sales
- flow of electricity over time, expressed in watt-hours or multiples:
  - kilowatt-hours or kWh (e.g. customer level)
  - megawatt-hours or MWh (e.g. plant level)
  - gigawatt-hours or GWh (e.g. utility level)
  - terawatt-hours or TWh (e.g. country level)

From capacity to generation
- A 1-MW unit operating at full capacity over one hour generates 1 MWh of electricity.
- Over one year, this unit could generate up to 8,760 MWh (1 MW × 24 hr × 365 days).
• Units are rarely used at full capacity over time because of factors such as maintenance requirements, resource limitations and low demand.
• “Capacity factor” is the ratio of actual generation to full capacity potential.

ENERGY CONTENT

Rather than using “natural” units (e.g. volume, weight), energy sources can be measured according to their energy content – this allows comparison between energy sources.

• metric: joules or multiples (gigajoules or GJ, terajoules or TJ, petajoules or PJ)
• U.S.: 1 British thermal unit (BTU) = 1,055.06 joules
• IEA: energy balances expressed in oil equivalent:
  • thousand tonnes of oil equivalent (ktoe)
  • million tonnes of oil equivalent (Mtoe)

Typical values
• 1 m³ of crude oil = 39.0 GJ
• 1,000 m³ of natural gas = 38.3 GJ
• 1 MWh of electricity = 3.6 GJ
• 1 metric tonne of coal = 29.3 GJ
• 1 metric tonne of wood waste = 18.0 GJ
• 1 metric tonne of uranium = 420,000 GJ to 672,000 GJ
## ANNEX 2: ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AECO</td>
<td>Alberta Energy Company</td>
</tr>
<tr>
<td>B</td>
<td>billion</td>
</tr>
<tr>
<td>b/d</td>
<td>barrels per day</td>
</tr>
<tr>
<td>Bcf/d</td>
<td>billion cubic feet per day</td>
</tr>
<tr>
<td>Bcm/d</td>
<td>billion cubic metres per day</td>
</tr>
<tr>
<td>CANDU</td>
<td>Canada deuterium uranium</td>
</tr>
<tr>
<td>CCS</td>
<td>carbon capture and storage</td>
</tr>
<tr>
<td>CCUS</td>
<td>carbon capture, utilization and storage</td>
</tr>
<tr>
<td>CDIA</td>
<td>Canadian direct investment abroad</td>
</tr>
<tr>
<td>CEA</td>
<td>Canadian energy assets</td>
</tr>
<tr>
<td>CER</td>
<td>Canada Energy Regulator</td>
</tr>
<tr>
<td>CO₂ equivalent</td>
<td>carbon dioxide equivalent</td>
</tr>
<tr>
<td>CPI</td>
<td>consumer price index</td>
</tr>
<tr>
<td>CPL</td>
<td>cents per litre</td>
</tr>
<tr>
<td>ECTPEA</td>
<td>Environmental and Clean Technology Products Economic Account</td>
</tr>
<tr>
<td>EIA</td>
<td>Energy Information Administration (U.S.)</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FDI</td>
<td>foreign direct investment</td>
</tr>
<tr>
<td>G7</td>
<td>seven wealthiest major developed nations: Canada, France, Germany, Italy, Japan, U.K. and U.S.</td>
</tr>
<tr>
<td>GDP</td>
<td>gross domestic product</td>
</tr>
<tr>
<td>GHG</td>
<td>greenhouse gas</td>
</tr>
<tr>
<td>GJ</td>
<td>gigajoule</td>
</tr>
<tr>
<td>GST</td>
<td>Goods and Services tax</td>
</tr>
<tr>
<td>GWh</td>
<td>gigawatt hours</td>
</tr>
<tr>
<td>HGL</td>
<td>hydrocarbon gas liquids</td>
</tr>
<tr>
<td>HST</td>
<td>Harmonized sales tax</td>
</tr>
<tr>
<td>IEA</td>
<td>International Energy Agency</td>
</tr>
<tr>
<td>kg</td>
<td>kilogram</td>
</tr>
<tr>
<td>km</td>
<td>kilometre</td>
</tr>
<tr>
<td>km²</td>
<td>square kilometre</td>
</tr>
<tr>
<td>kt</td>
<td>kilotonne</td>
</tr>
<tr>
<td>kWh</td>
<td>kilowatt hour</td>
</tr>
<tr>
<td>lb.</td>
<td>pound</td>
</tr>
<tr>
<td>L</td>
<td>litre</td>
</tr>
<tr>
<td>LCOE</td>
<td>levelized cost of electricity</td>
</tr>
<tr>
<td>LNG</td>
<td>liquefied natural gas</td>
</tr>
<tr>
<td>LPG</td>
<td>liquefied petroleum gases</td>
</tr>
<tr>
<td>LWR</td>
<td>light water reactor</td>
</tr>
<tr>
<td>m</td>
<td>metre</td>
</tr>
<tr>
<td>m²</td>
<td>square metre</td>
</tr>
<tr>
<td>m³</td>
<td>cubic metre</td>
</tr>
<tr>
<td>Mb/d</td>
<td>thousand barrels per day</td>
</tr>
<tr>
<td>MJ</td>
<td>megajoule</td>
</tr>
<tr>
<td>MMb/d</td>
<td>million barrels per day</td>
</tr>
<tr>
<td>MMcf/d</td>
<td>million cubic feet per day</td>
</tr>
<tr>
<td>MMbtu</td>
<td>million British thermal units</td>
</tr>
<tr>
<td>Mt</td>
<td>million tonnes; megatonne</td>
</tr>
<tr>
<td>Mtoe</td>
<td>million tons of oil equivalent</td>
</tr>
<tr>
<td>MW</td>
<td>megawatt</td>
</tr>
<tr>
<td>NGL</td>
<td>natural gas liquids</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
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<tr>
<td>NRCan</td>
<td>Natural Resources Canada</td>
</tr>
<tr>
<td>NRSA</td>
<td>Natural Resources Satellite Account</td>
</tr>
<tr>
<td>NSERC</td>
<td>National Science and Engineering Research Council of Canada</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<tr>
<td>PHWR</td>
<td>pressurized heavy water reactor</td>
</tr>
<tr>
<td>PJ</td>
<td>petajoule</td>
</tr>
<tr>
<td>Pkm</td>
<td>passenger-kilometre</td>
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<td>Provinces</td>
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<td>Alta.</td>
<td>Alberta</td>
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<td>British Columbia</td>
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<td>New Brunswick</td>
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<td>Newfoundland and Labrador</td>
</tr>
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<td>Nova Scotia</td>
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<td>Northwest Territories</td>
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<td>Ont.</td>
<td>Ontario</td>
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<tr>
<td>P.E.I.</td>
<td>Prince Edward Island</td>
</tr>
<tr>
<td>Que.</td>
<td>Quebec</td>
</tr>
<tr>
<td>Sask.</td>
<td>Saskatchewan</td>
</tr>
<tr>
<td>Y.T.</td>
<td>Yukon</td>
</tr>
<tr>
<td>Atl.</td>
<td>Atlantic provinces</td>
</tr>
<tr>
<td>Terr.</td>
<td>Territories</td>
</tr>
<tr>
<td>P/T</td>
<td>provincial/territorial</td>
</tr>
<tr>
<td>PV</td>
<td>photovoltaic</td>
</tr>
<tr>
<td>RD&amp;D</td>
<td>research, development and demonstration</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>research and development</td>
</tr>
<tr>
<td>RPP</td>
<td>refined petroleum products</td>
</tr>
<tr>
<td>SDTC</td>
<td>Sustainable Development Technology Canada</td>
</tr>
<tr>
<td>Tcf</td>
<td>trillion cubic feet</td>
</tr>
<tr>
<td>Tcm</td>
<td>trillion cubic metres</td>
</tr>
<tr>
<td>Tkm</td>
<td>tonne-kilometre</td>
</tr>
<tr>
<td>t</td>
<td>tonnes</td>
</tr>
<tr>
<td>TPES</td>
<td>total primary energy supply</td>
</tr>
<tr>
<td>TWh</td>
<td>terawatt-hour</td>
</tr>
<tr>
<td>U.K.</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>U.S.</td>
<td>United States</td>
</tr>
<tr>
<td>US$</td>
<td>United States dollars</td>
</tr>
<tr>
<td>WTI</td>
<td>West Texas Intermediate</td>
</tr>
</tbody>
</table>
ANNEX 3: SOURCES

SECTION 1: KEY ENERGY, ECONOMIC AND ENVIRONMENTAL INDICATORS

• ENERGY PRODUCTION AND SUPPLY
  • Global Primary Energy Production: IEA Annual Database
  • Global Energy Rankings: IEA Annual Database
  • Primary Energy Production by Region & Source:
    Statistics Canada tables 25-10-0020-01, 25-10-0029-01 and 25-10-0007-01 and NRCan estimates
  • Total primary energy supply: IEA Annual Database, World Energy Balances and IEA Standing Group on Long-Term Co-operation questionnaire
  • Primary and secondary energy use: Natural Resources Canada’s National Energy Use Database

• ECONOMIC CONTRIBUTION
  • GDP: Statistics Canada tables 38-10-0285-01, 36-10-0221-01, 36-10-0103-01 and 36-10-0400-01 and NRCan estimates
  • Employment:
    Statistics Canada tables 38-10-0285-01, 36-10-0214-01, 36-10-0489-01, 36-10-0480-01, 36-10-0221-01, 36-10-0400-01, 14-10-0023-01, Provincial NRSA and Statistics Canada special tabulations
  • Energy Trade: Statistics Canada International Merchandise Trade Database, IEA Annual Database and United States EIA (U.S. Imports by Country of Origin)
  • Canada-U.S. Energy Trade: Statistics Canada International Merchandise Trade Database and United States EIA (U.S. Imports by Country of Origin)
  • Government Revenues: Statistics Canada
    Table 33-10-0006-01, Statistics Canada special tabulation (royalties) and Canadian Association of Petroleum Producers, Statistical Handbook, Table 01-01C (Crown land sales Western Canada and Canada lands)

• ENERGY AND GHG EMISSIONS
  • GHG Emissions by Sector: Environment and Climate Change Canada (National Inventory Report)

SECTION 2: INVESTMENT

• Capital expenditures: Statistics Canada tables 34-10-0035-01, 34-10-0036-01, and 34-10-0040-01
• Canada’s Energy Infrastructure: StatCan Table: 36-10-0608-01:
  Infrastructure Economic Accounts, investment and net stock by asset, industry, and asset function
• Canada’s Major Energy Projects: NRCan Major Project Inventory
• Foreign Direct Investment and Canadian Direct Investment Abroad: Statistics Canada Table 36-10-0009-01
• Foreign Control of Canadian Assets: Statistics Canada tables 33-10-0033-01, 33-10-0005-01 and 33-10-0006-01
• Canadian Energy Assets: Compiled by NRCan from S&P Global Market Intelligence and annual financial statements from publicly traded Canadian energy companies.
• Research, Development and Demonstration
• Environmental Protection Expenditures: StatCan Environmental protection expenditures by businesses, 2018 (Tables 38-10-0130-01, 38-10-0132-01)
SECTION 3: SKILLS, DIVERSITY AND COMMUNITY

- **Energy Sector Demographics**: Statistics Canada Natural Resources Account, special release tables.
- **Household Expenditures on Energy**: Statistics Canada Table 11-10-0222-01
- **Energy Retail Prices**: Statistics Canada tables 18-10-0004-01 and 18-10-0001-01
- **Energy Reliant Communities**: NRCan analysis based on Statistics Canada 2016 Census Data

SECTION 4: ENERGY EFFICIENCY

- **ENERGY USE**
  - **Primary and secondary energy use**: Natural Resources Canada’s National Energy Use Database
  - **Energy efficiency**: Natural Resources Canada’s National Energy Use Database and Natural Resources Canada Energy Efficiency Trends in Canada 2000-2018
  - **Energy intensity**: Natural Resources Canada’s National Energy Use Database
  - **Energy in our daily lives**: Natural Resources Canada’s Energy Efficiency Trends in Canada 2000-2018
  - **Residential Energy Use, water heating and space heating**: Natural Resources Canada’s National Energy Use Database and NRCan estimates
  - **Residential, commercial, institutional and industrial sectors**: Natural Resources Canada’s National Energy Use Database

- **ENERGY TRENDS**
  - **Trends in Energy use and intensity**: Natural Resources Canada’s National Energy Use Database

SECTION 5: CLEAN POWER AND LOW CARBON FUELS

- **CLEAN TECHNOLOGY AND THE ECONOMY**
  - **Environmental and clean technology**: compiled by NRCan from Statistics Canada data and other public sources (Toronto Stock Exchange)

- **ELECTRICITY**
  - **World production and exports**: IEA database (Electricity Information [note: IEA production/generation data is expressed on a “gross” basis, i.e. before generating station use])
  - **Trade**: CER Table (Electricity Exports and Imports Statistics), and Statistics Canada.
  - **Canadian and provincial supply**: compiled by Statistics Canada and NRCan’s Electricity Division from various sources
  - **Prices**: Hydro-Québec (Comparison of Electricity Prices in Major North American Cities)
  - **Electricity energy use**: Office of Energy Efficiency Comprehensive Energy Use Database.
  - **Levelized cost of electricity**: CER (Canada’s Adoption of Renewable Power Sources – Energy Market Analysis)

- **RENEWABLES**
  - **International context – Production**: IEA (Renewables Information)
  - **International context – share of energy supply**: IEA (Electricity Information, Energy Balances of OECD Countries, and Energy Balances of Non-OECD Countries) and United States EIA
  - **Domestic production**: IEA (Renewables Information) and NRCan data based on Statistics Canada
  - **Hydro – international generation**: IEA (Electricity Information, Energy Balances of OECD Countries, and Energy Balances of Non-OECD Countries)
- **Hydro – capacity in Canada**: Statistics Canada Table 25-10-0022-01 and compiled by NRCan
- **Hydro – facilities and projects**: compiled by NRCan from Statistics Canada and other public sources
- **Biomass – Renewable balance**: IEA database (Renewables balances)
- **Biomass – production**: Statistics Canada Table 25-10-0031-01, Statistics Canada International Merchandise Trade Database and NRCan
- **Biomass – wood fuel use by sector**: IEA (Renewables Information)
- **Wind – international context**: Global Wind Energy Council (Global Wind Report)
- **Wind – capacity in Canada**: compiled by NRCan from multiple sources (Canadian Wind Energy Association, Statistics Canada and NRCan)
- **Wind generation in Canada**: Statistics Canada Table 25-10-0020-01
- **Wind – wind farms**: compiled by NRCan from Statistics Canada data and other public sources (including Canadian Wind Energy Association)
- **Solar PV – capacity in Canada**: IEA and compiled by NRCan
- **Solar PV – generation in Canada**: Statistics Canada Table 25-10-0020-01
- **Solar PV – solar PV farms**: compiled by NRCan from Statistics Canada data and various public sources
- **URANIUM AND NUCLEAR**
  - **Biofuels – regulations**: compiled by Office of Energy Efficiency from various public sources
  - **World uranium production and exports**: World Nuclear Association (World Uranium Mining) and NRCan estimates based on World Nuclear Association production data
  - **World known recoverable resources of uranium**: OECD Nuclear Energy Agency and International Atomic Energy Agency (Uranium: Resource, Production and Demand), World Nuclear Association (Supply of Uranium)
  - **World generation of nuclear power**: International Atomic Energy Agency (Nuclear Power Reactors in the World, 2020 Ed.)
  - **Canadian supply and demand**: World Nuclear Association (Uranium in Canada), Cameco Annual report and estimates compiled by NRCan from company information
  - **Nuclear in Canada infographic**: NRCan website (Nuclear Energy and Uranium)
  - **Purchases by U.S. nuclear reactors**: United States EIA (Uranium Marketing Annual Report) Table 3 (Uranium purchased by owners and operators of U.S. civilian nuclear power reactors by origin country and delivery year)
  - **CANDU nuclear reactors**: Based on figures compiled by NRCan
  - **Nuclear power plants in Canada**: Compiled by NRCan from Statistics Canada Table 57-206, International Atomic Energy Agency Power Reactor Information System and other public sources
  - **Spot prices**: United States EIA Annual Uranium Market Report
- **BIOFUELS AND TRANSPORTATION**
  - **Biofuels – regulations**: compiled by Office of Energy Efficiency from various public sources
• **Biofuels – international context**: IEA (Renewables Information)

• **Biofuels – production, supply and demand**: Compiled by NRCan from a variety of sources

• **Transportation – Electric vehicle sales**: Statistics Canada Table: 20-10-0021-01

• **Transportation – GHG emissions**: Environment and Climate Change Canada


**SECTION 6: PETROLEUM, GAS AND COAL**

• **CRUDE OIL**
  - **World production and exports**: IEA Online Data Services (Crude Oil Information)
  - **World proved reserves**: Oil and Gas Journal (Worldwide Look at Reserves and Production)
  - **Canadian Resources**: Canadian Association of Petroleum Producers Statistical Handbook tables 2.6 (Crude Oil Remaining Established Reserves) and 2.1a (Crude Reserves) Alberta Energy Regulator ST98 (Alberta’s Energy Reserves and Supply/Demand Outlook), tables R4.5 (Conventional crude oil reserves as of each year-end), R4.1 (Reserve and production change highlights) and 1 (Resources, reserves and production summary)
  - **Wells completed and metres drilled in western Canada**: Canadian Association of Petroleum Producers, Statistical Handbook, Wells and Metres Drilled in Western Canada (2020 Drilling Activity)
  - **Canadian and provincial production**: Statistics Canada Table 25-10-0063-01 and NRCan analysis
  - **Canadian Supply and Demand**: Statistics Canada Table 25-10-0063-01 and Statistics Canada International Merchandise Trade Database, United States EIA (Imports by Country of Origin, Refining and Processing, total crude oil and products, consumption/sales)
  - **Trade**: Statistics Canada table 25-10-0063-01 and Statistics Canada International Merchandise Trade Database, U.S. EIA (Imports by Country of Origin, Refining and Processing, total crude oil and products, consumption/sales)
  - **Oil Sands**: Canadian Association of Petroleum Producers, Statistical Handbook, Table 04-14 (Canada Oil Sands Expenditures), Statistics Canada tables 34-10-0036-01 and 25-10-0063-01, Alberta Energy Regulator ST98 (Alberta’s Energy Reserves and Supply/Demand Outlook) table S3.1 (Crude bitumen production), Canada’s Oil Sands Innovation Alliance, CanOils Database and NRCan analysis
  - **Prices**: United States EIA tables (Spot Prices for Crude Oil) and Sproule
  - **Pipelines**: compiled by NRCan
  - **Transportation by Rail**: CER (Canadian Crude Oil Exports by Rail – Quarterly Data), Statistics Canada table 23-10-0062-01 and various sources

148 Energy Fact Book
Canada, NRCan Boreal forest website, Alberta Government Lower Athabasca Regional Plan and Canadian Association of Petroleum Producers (Frequently used statistics)

**NATURAL GAS**

- **World production and exports**: IEA (Natural Gas Information)
- **World proved reserves**: U.S. EIA, International Data Browser
- **World unproved technically recoverable shale resources**: U.S. EIA, World Shale Resource Assessments
- **World resources and technically recoverable resources**: IEA (World Energy Outlook 2017, 2014 and 2013) tables 5.3 (Remaining technically recoverable natural gas resources by type and region), 8.2 (Remaining technically recoverable natural gas resources by type) and 3.3 (Remaining technically recoverable natural gas resources by type and region) and Oil and Gas Journal (Worldwide Look at Reserves and Production)
- **Canada and US proved reserves**: U.S. EIA and O&G Journal, extracted from EIA International Data Browser
- **Marketable and technically recoverable resources**: CER Energy Future Report, EIA Annual Energy Outlook, Assumptions to AEO - Oil and Gas Supply Module, EIA Shale gas proved reserves, IEA World Energy Outlook
- **Canadian production and share of conventional versus unconventional production**: StatCan Table: 25-10-0055-01 Natural gas supply and disposition and CER Energy Futures, Natural Gas Production by Type
- **US production and share of conventional versus unconventional production**: U.S. EIA, Dry Natural Gas Production, Annual and US EIA Annual Energy Outlook
- **LNG Imports of North American countries**: CER LNG Imports and Exports, U.S. EIA Liquefied Natural Gas Imports and Exports, Annual, and IGU World LNG Report
- **Natural gas wells completed and average metres drilled**: CAPP, Statistical Handbook
- **Canadian trade of natural gas**: CER Exports and Imports of Natural Gas
- **Marketable Production by Province**: StatCan Table: 25-10-0055-01 Natural gas supply and disposition
- **Prices**: Sproule Price Forecast
- **Pipelines**: Canada Energy Regulator
- **Natural gas energy use**: NRCan Office of Energy Efficiency, National Energy Use Database
- **Consumption**: Statistics Canada Table 25-10-0030-01 and IEA Annual Mini-Questionnaire

**HGLs**

- **Processing plant production**: StatCan Table 25-10-0036-01 - Supply of natural gas liquids and sulphur products from processing plants
- **Shares of NGL Production by province**: CAPP Statistical Handbook
- **NGLs end use**: NRCan Office of Energy Efficiency, National Energy Use Database

**RPPs**

- **Canadian refineries**: compiled by NRCan (from company information, Conference Board of Canada, Canada’s Petroleum Refining Sector Canadian Fuels Association, Canadian Association of Petroleum Producers, Oil Sands magazine and CanOils Database)
- **Supply and Demand**: Statistics Canada Tables, 25-10-0063-01 and 25-10-0081-01 and NRCan Analysis
• **Crude oil shipped to domestic refineries:** Statistics Canada table 25-10-0063-01

• **Domestic consumption by product:** Statistics Canada table 25-10-0081-01 and analysis by NRCan

• **Trade:** Statistics Canada Table 25-10-0081-01, United States EIA (U.S. Imports by Country of Origin for Petroleum and Other Liquids) and Statistics Canada International Merchandise Trade Database

• **Gasoline prices:** Kalibrate Technologies Ltd (average retail prices for regular gasoline and diesel fuel) and data compiled by NRCan

• **Refinery capacity:** Oil sands magazine and estimates compiled by NRCan

• **COAL**
  
  • **World proved reserved:** World Energy Council (BP Statistical Review of World Energy)

  • **World production and exports:** IEA (Coal Information)

  • **Canadian supply and demand:** Public provincial data sources, Statistics Canada table 25-10-0017-01, Statistics Canada International Merchandise Trade Database, public sources and NRCan estimations

• **GHG EMISSIONS FROM PETROLEUM**

  • **GHG Emissions by Sector:** Environment and Climate Change Canada (National Inventory Report)